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P0001   ..... RP-TO-R SUBROUTINE .....
R0002   SUBROUTINE TO CONVERT RP (VECTOR IN PLANETARY COORDINATE SYSTEM,EITHER
R0003   EARTH-FIXED OR MOON-FIXED) TO R (SAME VECTOR IN THE BASIC REP. SYSTEM)

R0004   R=MT(T)*(RP+LPXRP)   MT= M MATRIX TRANSPOSE

R0005   CALLING SEQUENCE
R0006   L   CALL
R0007   L+1   RP-TO-R

R0008   SUBROUTINES USED
R0009   EARTHMX,MOONMX,EARTHL

R0010   ITEMS AVAILABLE FROM LAUNCH DATA
R0011   504LM= THE LIBRATION VECTOR L OF THE MOON AT TIME TIMSUBL,EXPRESSED
R0012   IN THE MOON-FIXED COORD. SYSTEM   RADIANS B0
R0013   ITEMS NECESSARY FOR SUBR. USED (SEE DESCRIPTION OF SUBR.)

R0014   INPUT
R0015   MPAC= 0 FOR EARTH,NON-ZERO FOR MOON
R0016   0-5D= RP VECTOR
R0017   6-7D= TIME

R0018   OUTPUT
R0019   MPAC= R VECTOR METERS B-29 FOR EARTH, B-27 FOR MOON

0020	REF	1		26,2000				SETLOC	PLANTIN	
0021	·			26,3341				BANK		
0022	REF	1						COUNT*	SS/LUROT	
0023				26,3341	46020 1	RP-TO-R	STQ	BHIZ .		
0024	REF	1		26,3342	00050 1			RPREXIT		
0025	REF	1		26,3343	55356 1			RPTORA		
0026				26,3344	77624 1		CALL		COMPUTE M MATRIX FOR MOON
0027	REF	1		26,3345	55416 1			MOONMX	LP=LM FOR MOON RADIANS B0
0028				26,3346	77775 1		VLOAD		
0029	REF	1		26,3347	02012 0			504LM	
0030				26,3350	53235 0	RPTORB	VXV	VAD	
0031	REF	1		26,3351	00001 0			504RPR	
0032	REF	2	LAST 1213	26,3352	00001 0			504RPR	
0033				26,3353	52105 1		VXM	GOTO	
0034	REF	1		26,3354	00025 0			MMATRIX	MPAC=R=MT(T)*(RP+LPXRP)
0035	REF	1		26,3355	55404 1			RPRPXXXX	RESET PUSHLOC TO 0 BEFORE EXITING
0036				26,3356	77624 1	RPTORA	CALL		EARTH COMPUTATIONS
0037	REF	1		26,3357	55570 0			EARTHMX	M MATRIX B-1
0038				26,3360	77624 1		CALL		
0039	REF	1		26,3361	55622 1			EARTHL	L VECTOR RADIANS B0
0040				26,3362	76521 0		MXV	VSL1	LP=M(T)*L, RAD B-0
0041	REF	2	LAST 1213	26,3363	00025 0			MMATRIX	

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0042			26,3364	77650 1		GOTO	
0043	REF	1	26,3365	55350 1			RPTORB

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P0044   ..... R-TO-RP SUBROUTINE .....
R0045   SUBROUTINE TO CONVERT R (VECTOR IN REFERENCE COORD. SYSTEM) TO RP
R0046   (VECTOR IN PLANETARY COORD SYSTEM) EITHER EARTH-FIXED OR MOON-FIXED

R0047   RP=M(T)*(R-LXR)

R0048   CALLING SEQUENCE
R0049   L   CALL
R0050   L+1   R-TO-RP

R0051   SUBROUTINES USED
R0052   EARTHMX,MOONMX,EARTHL

R0053   INPUT
R0054   MPAC= 0 FOR EARTH,NON-ZERO FOR MOON
R0055   0-5D= R VECTOR
R0056   6-7D= TIME

R0057   ITEMS AVAILABLE FROM LAUNCH DATA
R0058   504LM= THE LIBRATION VECTOR L OF THE MOON AT TIME TIMSUBL,EXPRESSED
R0059   IN THE MOON-FIXED COORD. SYSTEM   RADIANS B0
R0060   ITEMS NECESSARY FOR SUBROUTINES USED (SEE DESCRIPTION OF SUBR.)

R0061   OUTPUT
R0062   MPAC=RP VECTOR METERS B-29 FOR EARTH, B-27 FOR MOON

0063					26,3366	46020 1	R-TO-RP	STQ	BHIZ	
0064	REF	2	LAST	1213	26,3367	00050 1			RPREXIT	
0065	REF	1			26,3370	55410 1			RTORPA	
0066					26,3371	77624 1		CALL		
0067	REF	2	LAST	1213	26,3372	55416 1			MOONMX	
0068					26,3373	61375 1		VLOAD	VXM	
0069	REF	2	LAST	1213	26,3374	02012 0			504LM	LP=LM
0070	REF	3	LAST	1213	26,3375	00025 0			MMATRIX	
0071					26,3376	77772 0		VSL1		L=MT(T)*LP RADIANS B0
0072					26,3377	51235 1	RTORPB	VXV	BVSU	
0073	REF	3	LAST	1213	26,3400	00001 0			504RPR	
0074	REF	4	LAST	1215	26,3401	00001 0			504RPR	
0075					26,3402	77721 0		MXV		M(T)*(R-LXR) B-2
0076	REF	4	LAST	1215	26,3403	00025 0			MMATRIX	
0077					26,3404	40372 0	RPRPXXXX	VSL1	SETPD	
0078					26,3405	00001 0			0D	
0079					26,3406	77650 1		GOTO		
0080	REF	3	LAST	1215	26,3407	00050 1			RPREXIT	
0081					26,3410	77624 1	RTORPA	CALL		EARTH COMPUTATIONS
0082	REF	2	LAST	1213	26,3411	55570 0			EARTHMX	
0083					26,3412	77624 1		CALL		
0084	REF	2	LAST	1213	26,3413	55622 1			EARTHL	
0085					26,3414	77650 1		GOTO		MPAC=L=(-AX,-AY,0) RAD B-0
0086	REF	1			26,3415	55377 1			RTORPB	

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P0007     ..... MOONMX SUBROUTINE .....
R0088     SUBROUTINE TO COMPUTE THE TRANSFORMATION MATRIX M FOR THE MOON

R0089     CALLING SEQUENCE
R0090     L      CALL
R0091     L+1             MOONMX

R0092     SUBROUTINES USED
R0093     NEWANGLE

R0094     INPUT
R0095     0-TD= TIME
R0096       ITEMS AVAILABLE FROM LAUNCH DATA
R0097       BSUBO,BDOT
R0098       TIMSUBO,NODIO,NODDOT,FSUBO,FDOT
R0099       COSI= COS(I) B-1
R0100      ·SINI= SIN(I) B-1
R0101         I  IS THE ANGLE BETWEEN THE MEAN LUNAR EQUATORIAL PLANE AND THE
R0102           PLANE OF THE ECLIPTIC  (1 DEGREE  32.1 MINUTES)

R0103     OUTPUT
R0104     MMATRIX= 3X3 M MATRIX B-1    (STORED IN VAC AREA)
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0105				26,3416	40220 0	MOONMX	STQ	SETPD	
0106	REP	1		26,3417	00051 0			EARTHMXX	
0107				26,3420	00011 1			8D	
0108				26,3421	77770 1		AXT,1		B REQUIRES SL 0, SL 5 IN NEWANGLE
0109				26,3422	00005 1			5	
0110				26,3423	65345 0		DLOAD	PDDL	PD 10D 8-9D=BSUBO
0111	REP	1		26,3424	15852 1			BSUBO	10-11D= BDOT
0112	REP	1		26,3425	15644 0			BDOT	
0113				26,3426	45006 0		PUSH	CALL	PD 12D
0114	REP	1		26,3427	55543 0			NEWANGLE	EXIT WITH PD 8D AND MPAC= B REVS B0
0115				26,3430	71406 0		PUSH	COS	PD 10D
0116	REP	1		26,3431	14041 1		STODL	COB	PD 8D COS(B) B-1
0117				26,3432	77756 0		SIN		SIN(B) B-1
0118	REP	1		26,3433	14043 0		STODL	SOB	SETUP INPUT FOR NEWANGLE
0119	REP	1		26,3434	15650 0			FSUBO	8-9D=FSUBO
0120				26,3435	41525 0		PDDL	PUSH	PD 10D THEN 12D 10-11D=FDOT
0121	REP	1		26,3436	15642 0			FDOT	
0122				26,3437	45170 0		AXT,1	CALL	F REQUIRES SL 1, SL 6 IN NEWANGLE
0123				26,3440	00004 0			4	
0124	REP	2	LAST 1216	26,3441	55543 0			NEWANGLE	EXIT WITH PD 8D AND MPAC= F REVS B0
0125	REP	1		26,3442	14027 1		STODL	AVECTR +2	SAVE F TEMP
0126	REP	1		26,3443	15646 1			NODIO	8-9D=NODIO
0127				26,3444	41525 0		PDDL	PUSH	PD 10D THEN 12D 10-11D=NODDOT
0128	REP	1		26,3445	15640 1			NODDOT	MPAC=T
0129				26,3446	45170 0		AXT,1	CALL	NODE REQUIRES SL 0, SL 5 IN NEWANGLE
0130				26,3447	00005 1			5	
0131	REP	3	LAST 1216	26,3450	55543 0			NEWANGLE	EXIT WITH PD 8D AND MPAC= NODI REVS B0

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Line	REP			Address	Octal		Instr	Operand	Comment
0132				26,3451	71406	0	PUSH	COS	PD 10D 6-9D= NODI REVS B0
0133				26,3452	77606	1	PUSH		PD 12D 10-11D= COS(NODI) B-1
0134	REP	2	LAST 1216	26,3453	00025	0	STORE	AVECTR	
0135				26,3454	76405	1	DMP	SL1R	
0136	REP	2	LAST 1216	26,3455	00041	1		COB	COS(NODI) B-1
0137	REP	1		26,3456	14035	1	STODL	BVECTR +2	PD 10D 20-25D=AVECTR= COB*SIN(NODI)
0138				26,3457	76405	1	DMP	SL1R	SOB*SIN(NODI)
0139	REP	2	LAST 1216	26,3460	00043	1		SOB	
0140	REP	2	LAST 1217	26,3461	14037	0	STODL	BVECTR +4	PD 8D
0141				26,3462	41556	1	SIN	PUSH	PD 10D -SIN(NODI) B-1
0142				26,3463	77676	0	DCOMP		26-31D=BVECTR= COB*COS(NODI)
0143	REP	3	LAST 1217	26,3464	14033	1	STODL	BVECTR	PD 8D SOB*COS(NODI)
0144	REP	3	LAST 1217	26,3465	00027	1		AVECTR +2	MOVE P FROM TEMP LOC. TO 504P
0145	REP	1		26,3466	14007	0	STODL	504P	
0146				26,3467	76405	1	DMP	SL1R	
0147	REP	3	LAST 1217	26,3470	00041	1		COB	
0148	REP	4	LAST 1217	26,3471	14027	1	STODL	AVECTR +2	
0149	REP	1		26,3472	00011	1		SINNODI	8-9D=SIN(NODI) B-1
0150				26,3473	76405	1	DMP	SL1R	
0151	REP	3	LAST 1217	26,3474	00043	1		SOB	
0152	REP	5	LAST 1217	26,3475	14031	0	STODL	AVECTR +4	
0153	REP	26	LAST 893	26,3476	15332	1		HI6ZEROS	6-13D= CVECTR= -SOB B-1
0154				26,3477	57525	1	PDDL	DCOMP	PD 10D COB
0155	REP	4	LAST 1217	26,3500	00043	0		SOB	
0156				26,3501	63325	0	PDDL	PDVL	PD 12D THEN PD 14D
0157	REP	4	LAST 1217	26,3502	00041	1		COB	
0158	REP	4	LAST 1217	26,3503	00033	1		BVECTR	
0159				26,3504	63361	0	VXSC	PDVL	PD 20D BVECTR*SINI B-2
0160	REP	1		26,3505	15636	0		SINI	
0161	REP	1		26,3506	00011	1		CVECTR	
0162				26,3507	53361	0	VXSC	VAD	PD 14D CVECTR*COSI B-2
0163	REP	1		26,3510	15634	1		COSI	
0164				26,3511	77772	0	VSL1		
0165	REP	5	LAST 1215	26,3512	24041	1	STOVL	MMATRIX +12D	PD 8D M2=BVECTR*SINI+CVECTR*COSI B-1
0166				26,3513	63361	0	VXSC	PDVL	PD 14D
0167	REP	2	LAST 1217	26,3514	15636	0		SINI	CVECTR*SINI B-2
0168	REP	5	LAST 1217	26,3515	00033	1		BVECTR	
0169				26,3516	52361	1	VXSC	VSU	PD 8D BVECTR*COSI B-2
0170	REP	2	LAST 1217	26,3517	15634	1		COSI	
0171				26,3520	65372	1	VSL1	PDDL	PD 14D
0172	REP	2	LAST 1217	26,3521	00007	0		504P	8-13D=DVECTR=BVECTR*COSI-CVECTR*SINI B-1
0173				26,3522	74346	0	COS	VXSC	
0174	REP	1		26,3523	00011	1		DVECTR	
0175				26,3524	73525	1	PDDL	SIN	PD 20D 14-19D= DVECTR*COSP B-2
0176	REP	3	LAST 1217	26,3525	00007	0		504P	
0177				26,3526	52361	1	VXSC	VSU	PD 14D AVECTR*SINP B-2
0178	REP	6	LAST 1217	26,3527	00025	0		AVECTR	
0179				26,3530	77772	0	VSL1		
0180	REP	6	LAST 1217	26,3531	14033	1	STODL	MMATRIX +6	M1= AVECTR*SINP-DVECTR*COSP B-1
0181	REP	4	LAST 1217	26,3532	00007	0		504P	

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0162				26,3533	74356 1	SIN	VXSC	PD 8D
0183				26,3534	71525 0	PDDL	COS	PD 14D 8-13D=DVECTR*SINP .B-2
0184	REF	5	LAST 1217	26,3535	00007 0		504P	
0185				26,3536	53361 0	VXSC	VAD	PD 8D AVECTR*COSP B-2
0186	REF	7	LAST 1217	26,3537	00025 0		AVECTR	
0167				26,3540	57572 0	VSL1	VCOMP	
0188	REF	7	LAST 1217	26,3541	34025 1	STCALL	MMATRIX	M0= -(AVECTR*COSP+DVECTR*SINP) B-1
0189	REF	2	LAST 1216	26,3542	00051 0		EARTHMXX	
R0190	COMPUTE X=X0+(XDOT)(T+T0)							
R0191	6-9D= X0 (REVS B-0),PUSHLOC SET AT 12D							
R0192	10-11D=XDOT (REVS/CSEC) SCALED B+23 FOR WEARTH,B+28 FOR NODDOT AND BDOT							
R0193	AND B+27 FOR FDOT							
R0194	X1=DIFFERENCE IN 23 AND SCALING OF XDOT,=0 FOR WEARTH,5 FOR NODDOT AND							
R0195	BDOT AND 4 FOR FDOT							
R0196	6-7D=T (CSEC B-28), TIMSUBO= (CSEC B-42 TRIPLE PREC.)							
0197				26,3543	54345 1	NEWANGLE DLOAD	SR	ENTER PD 12D
0198				26,3544	00007 0		6D	
0199				26,3545	20617 0		14D	
0200				26,3546	72371 1	TAD	TLOAD	CHANGE MODE TO TP
0201	REF	1		26,3547	01707 0		TIMSUBO	
0202	REF	848	LAST 1183	26,3550	00155 0		MPAC	
0203	REF	1		26,3551	14017 1	STODL	TIMSUBM	T+T0 CSEC B-42
0204	REF	2	LAST 1218	26,3552	00020 0		TIMSUBM +1	
0205				26,3553	77605 1	DMP		PD 10D MULT BY XDOT IN 10-11D
0206				26,3554	43257 0	SL*	DAD	PD 8D ADD X0 IN 8-9D AFTER SHIFTING
0207				26,3555	20206 1		5,1	SUCH THAT SCALING IS B-0
0208				26,3556	67206 1	PUSH	SLOAD	PD 10D SAVE PARTIAL (X0+XDOT*T) IN 8-9D
0209	REF	3	LAST 1218	26,3557	00017 1		TIMSUBM	
0210				26,3560	41261 1	SL	DMP	
0211				26,3561	20212 1		9D	
0212				26,3562	00013 0		10D	XDOT
0213				26,3563	43257 0	SL*	DAD	PD 8D SHIFT SUCH THAT THIS PART OF X
0214				26,3564	20213 0		10D,1	IS SCALED REVS/CSEC B-0
02141				26,3565	77600 1	BOV		TURN OFF OVERFLOW IF SET BY SHIFT
02142				26,3566	55567 0		+1	INSTRUCTION BEFORE EXITING
0215				26,3567	77616 0	RVO		MPAC=X= X0+(XDOT)(T+T0) REVS B0

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P0216   ..... EARTHMX SUBROUTINE .....
R0217   SUBROUTINE TO COMPUTE THE TRANSFORMATION MATRIX M FOR THE EARTH

R0218   CALLING SEQUENCE
R0219   L   CALL
R0220   L+1   EARTHMX

R0221   SUBROUTINES USED
R0222   NEWANGLE

R0223   INPUT
R0224   INPUT AVAILABLE FROM LAUNCH DATA   AZO   REVS B-0
R0225   TEPHEM CSEC B-42
R0226   6-7D= TIME CSEC B-28

R0227   OUTPUT
R0228   MMATRIX= 3X3 M MATRIX B-1   (STORED IN VAC AREA)

0229					26,3570	40220 0	EARTHMX	STO	SETPD	SET 8-9D=AZO
0230	REF	3	LAST	1216	26,3571	00051 0			EARTHMXX	
0231					26,3572	00011 1			8D	10-11D=WEARTH
0232					26,3573	77770 1		AXT,1		FOR SL 5, AND SL 10 IN NEWANGLE
0233					26,3574	00000 1			0	
0234					26,3575	65345 0		DLOAD	PDDL	LEAVING PD SET AT 12D FOR NEWANGLE
0235	REF	1			26,3576	01712 1			AZO	
0236	REF	1			26,3577	15654 1			WEARTH	
0237					26,3600	45006 0		PUSH	CALL	
0238	REF	4	LAST	1216	26,3601	55543 0			NEWANGLE	
0239					26,3602	41401 1		SETPD	PUSH	18-19D=504AZ
0240					26,3603	00023 0			18D	
0241					26,3604	65346 0		COS	PDDL	
0242	REF	1			26,3605	00023 0			504AZ	
0243					26,3606	65356 1		SIN	PDDL	
0244	REF	27	LAST	1217	26,3607	15332 1			HI6ZEROS	
0245					26,3610	73525 1		PDDL	SIN	
0246	REF	2	LAST	1219	26,3611	00023 0			504AZ	
0247					26,3612	65276 1		DCOMP	PDDL	
0248	REF	3	LAST	1219	26,3613	00023 0			504AZ	
0249					26,3614	63346 0		COS	PDVL	
0250	REF	28	LAST	1219	26,3615	15332 1			HI6ZEROS	
0251					26,3616	41525 0		PDDL	PUSH	
0252	REF	11	LAST	635	26,3617	15330 1			HIDPHALF	
0253					26,3620	77650 1		GOTO		
0254	REF	4	LAST	1219	26,3621	00051 0			EARTHMXX	

$$\text{20-37D= MMATRIX= } \begin{pmatrix} COS(AZ) & SIN(AZ) & 0 \\ -SIN(AZ) & COS(AZ) & 0 \\ 0 & 0 & 1 \end{pmatrix} B-1$$

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P0255     ..... EARTHL SUBROUTINE .....
R0256     SUBROUTINE TO COMPUTE L VECTOR FOR EARTH

R0257     CALLING SEQUENCE
R0258     L      CALL
R0259     L+1              EARTHL

R0260     INPUT
R0261     AXO,AYO SET AT LAUNCH TIME WITH AYO IMMEDIATELY FOLLOWING AXO IN CORE

R0262     OUTPUT
R0263              -AX
R0264     MPAC=    -AY      RADIANS B-0
R0265              0
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0266                                26,3622   57545 1   EARTHL   DLOAD   DCOMP
0267    REF    2   LAST   618       26,3623   01716 0                    AXO
0268    REF    1                    26,3624   14017 1            STODL   504LPL
0269    REF    2   LAST   618       26,3625   01714 1                    -AYO
0270    REF    2   LAST  1220       26,3626   14021 1            STODL   504LPL +2
0271    REF   29   LAST  1219       26,3627   15332 1                    HI6ZEROS
0272    REF    3   LAST  1220       26,3630   24023 0            STOVL   504LPL +4
0273    REF    4   LAST  1220       26,3631   00017 1                    504LPL
0274                                26,3632   77616 0            RVQ
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P0275   CONSTANTS AND ERASABLE ASSIGNMENTS

0276	REF 5 LAST 1210	04,3453		$1B_1$	=	$DP1/2$	1 SCALED B_{-1}
0277		26,3633	17775 1	COSI	2DEC	.99964115 B_{-1}	COS(1 DEG 32.1 MIN) B_{-1}
0277		26,3634	01734 0				
0278		26,3635	00333 1	SINI	2DEC	.02678760 B_{-1}	SIN(1 DEG 32.1 MIN) B_{-1}
0278		26,3636	16153 1				
0279	REF 38 LAST 1163	0050		RPREXIT	=	S1	R-TO-RP AND RP-TO-R SUBR EXIT
0280	REF 13 LAST 1212	0051		EARTHMXX	=	S2	EARTHMX,MOONMX SUBR. EXITS
0281		0000		504RPR	=	0D	6 REGS R OR RP VECTOR
0282		0010		SINNODI	=	8D	2 SIN(NODI)
0283		0010		DVECTR	=	8D	6 D VECTOR MOON
0284		0010		CVECTR	=	8D	6 C VECTOR MOON
0285		0022		504AZ	=	18D	2 AZ
0286		0016		TIMSUBM	=	14D	3 TIME SUB M (MOON) T+T0 IN GETAZ
0287		0016		504LPL	=	14D	6 L OR LP VECTOR
0288		0024		AVECTR	=	20D	6 A VECTOR (MOON)
0289		0032		BVECTR	=	26D	6 B VECTOR (MOON)
0290		0024		MMATRIX	=	20D	18 M MATRIX
0291		0040		COB	=	32D	2 COS(B) B_{-1}
0292		0042		SOB	=	34D	2 SIN(B) B_{-1}
0293		0006		504P	=	6D	2 P (MOON)
0297		26,3637	77665 1	NODDOT	2DEC	-.457335143 E-2	REVS/CSEC B+28=-1.07047016 E-8 RAD/SEC
0297		26,3640	42175 1				
0298		26,3641	22211 0	FDOT	2DEC	.570862491	REVS/CSEC B+27= 2.67240019 E-6 RAD/SEC
0298		26,3642	00265 0				
0299		26,3643	77777 0	BDOT	2DEC	-3.07500412 E-8	REVS/CSEC B+28=-7.19756666 E-14 RAD/SEC
0299		26,3644	77767 1				
0300		26,3645	41215 1	NODIO	2DEC	-.960101269	REVS B-0 = -6.03249419 RAD
0300		26,3646	66331 0				
0301		26,3647	15237 0	PSUBO	2DEC	.415998375	REVS B-0 = 2.61379488 RAD
0301		26,3650	26751 0				
0302		26,3651	02052 1	BSUBO	2DEC	.0651205006	REVS B-0 = 0.409164173 RAD
0302		26,3652	35713 1				
0303		26,3653	37116 0	WEARTH	2DEC	.973561855	REVS/CSEC B+23=7.29211515 E-5 RAD/SEC
0303		26,3654	32630 0				

P0001   INCORP1--PERFORMS THE SIX DIMENSIONAL STATE VECTOR DEVIATION FOR POSITI
R0002   ON AND VELOCITY OR THE NINE DIMENSIONAL DEVIATION OF POSITION,VELOCITY,A
R0003   ND RADAR OR LANDMARK BIAS.THE OUTPUT OF THE BVECTOR ROUTINE ALONG WITH T
R0004   HE ERROR TRANSITION MATRIX(W) ARE USED AS INPUT TO THE ROUTINE.THE DEVIA
R0005   TION IS OBTAINED BY COMPUTING AN ESTIMATED TRACKING MEASUREMENT FROM THE
R0006   CURRENT STATE VECTOR AND COMPARING IT WITH AN ACTUAL TRACKING MEASUREMEN
R0007   T AND APPLYING A STATISTICAL WEIGHTING VECTOR.
R0008   INPUT
R0009   DMENFLG = 0 6DIMENSIONAL BVECTOR 1= 9DIMENSIONAL
R0010   W = ERROR TRANSITION MATRIX 6X6 OR 9X9
R0011   VARIANCE = VARIANCE (SCALAR)
R0012   DELTAQ = MEASURED DEVIATION(SCALAR)
R0013   BVECTOR = 6 OR 9 DIMENSIONAL BVECTOR

R0014   OUTPUT
R0015   DELTAX = STATE VECTOR DEVIATIONS 6 OR 9 DIMENSIONAL
R0016   ZI = VECTOR USED FOR THE INCORPORATION 6 OR 9 DIMENSIONAL
R0017   GAMMA = SCALAR
R0018   OMEGA = OMEGA WEIGHTING VECTOR 6 OR 9 DIMENTIONAL
R0019   CALLING SEQUENCE
R0020   L CALL INCORP1

R0021   NORMAL EXIT

R0022   L+1 OF CALLING SEQUENCE

0023				37,3676			BANK	37	
0024	REF	1		36,2000			SETLOC	MEASINC	
0025				36,3250			BANK		
0026	REF	1					COUNT*	$$/INCOR	
0027	REF	57	LAST 624	E5,1400			EBANK=	W	
0028				36,3250	77620 0	INCORP1	STQ		
0029	REF	10	LAST 576	36,3251	02317 0			EGRESS	
0030				36,3252	66370 0		AXT,1	SSP	
0031				36,3253	00066 1			54D	
0032	REF	39	LAST 1221	36,3254	00051 0			S1	
0033				36,3255	00022 1			18D	IX1 = 54 S1= 18
0034				36,3256	66374 1		AXT,2	SSP	
0035				36,3257	00022 1			18D	
0036	REF	14	LAST 1221	36,3260	00052 0			S2	
0037				36,3261	00006 1			6	IX2 = 18 S2=6
0038				36,3262	63775 1	Z123	VLOAD	MXV*	
0039	REF	20	LAST 616	36,3263	03502 0			BVECTOR	BVECTOR (0)
0040	REF	58	LAST 1222	36,3264	02467 0			W +54D,1	
0041	REF	2	LAST 95	36,3265	12745 1		STORE	ZI +18D,2	
0042				36,3266	77775 1		VLOAD		
0043	REF	21	LAST 1222	36,3267	03510 0			BVECTOR +6	BVECTOR (1)

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0044					36,3270	52717 1		MXV*	VBO*	
0045	REF	59	LAST	1222	36,3271	02555 0			W +108D,1	
0046	REF	3	LAST	1222	36,3272	75032 1			ZI +18D,2	
0047	REF	4	LAST	1223	36,3273	12745 1		STORE	ZI +18D,2	
0048					36,3274	77775 1		VLOAD		
0049	REF	22	LAST	1222	36,3275	03516 0			BVECTOR +12D	BVECTOR (2)
0050					36,3276	52717 1		MXV*	VBO*	
0051	REF	60	LAST	1223	36,3277	02643 1			W +162D,1	
0052	REF	5	LAST	1223	36,3300	75032 1			ZI +18D,2	B(0)*W+B(1)*(W+54)+B(2)*(W+108)FIRST PAS
0053	REF	6	LAST	1223	36,3301	12745 1		STORE	ZI +18D,2	ZI THEN Z2 THEN Z3
0054					36,3302	77700 0		TIX,1		
0055	REF	1			36,3303	75304 1			INCOR1	
0056					36,3304	43104 0	INCOR1 TIX,2	BOV		
0057	REF	1			36,3305	75282 0			Z123	LOOP FOR Z1,Z2,Z3
0058	REF	8	LAST	617	36,3306	02706 1			DMENFLG	
0059	REF	1			36,3307	75313 1			INCOR1A	
0060					36,3310	77775 1		VLOAD		
0061	REF	20	LAST	624	36,3311	15332 1			ZEROVECS	
0062	REF	7	LAST	1223	36,3312	02737 0		STORE	ZI +12D	
0063					36,3313	77201 1	INCOR1A SETPD	VLOAD		
0064					36,3314	00001 0			0	
0065	REF	8	LAST	1223	36,3315	02723 0			ZI	
0066					36,3316	47036 1		VSQ	BTB	
0067	REF	7	LAST	873	36,3317	45562 1			TPMODE	
0068					36,3320	47515 0		PDVL	VSQ	
0069	REF	9	LAST	1223	36,3321	02731 0			ZI +6	
0070					36,3322	76234 0		RTB	TAD	
0071	REF	8	LAST	1223	36,3323	45562 1			TPMODE	
0072					36,3324	47515 0		PDVL	VSQ	
0073	REF	10	LAST	1223	36,3325	02737 0			ZI +12D	
0074					36,3326	76234 0		RTB	TAD	
0075	REF	9	LAST	1223	36,3327	45562 1			TPMODE	
0076					36,3330	77171 0		TAD	AXT,2	
0077	REF	12	LAST	617	36,3331	03526 0			VARIANCE	
0078					36,3332	00000 1			0	
0079	REF	1			36,3333	01257 0		STORE	TRIPA	ZI*2 + Z2*2 + Z3*2 + VARIANCE
0080					36,3334	40151 0		TLOAD	BOV	
0081	REF	13	LAST	1223	36,3335	03526 0			VARIANCE	CLEAR OVFIND
0082					36,3336	75337 1			+1	
0083	REF	1			36,3337	01262 0		STORE	TEMPVAR	TEMP STORAGE FOR VARIANCE
0084					36,3340	77654 0		BZE		
0085	REF	1			36,3341	75350 0			INCOR1C	
0086					36,3342	40112 1	INCOR1B SL2	BOV		
0087	REF	2	LAST	1223	36,3343	75350 0			INCOR1C	
0088	REF	2	LAST	1223	36,3344	01262 0		STORE	TEMPVAR	
0089					36,3345	52114 1		INCR,2	GOTO	
0090					36,3346	00001 0		DEC	1	
0091	REF	1			36,3347	75342 0			INCOR1B	
0092					36,3350	61551 1	INCOR1C TLOAD	ROUND		
0093	REF	2	LAST	1223	36,3351	01257 0			TRIPA	

0094					36,3352	75405 1	DMP	SQRT
0095	REP	3	LAST	1223	36,3353	01262 0		TEMPVAR
0096					36,3354	76257 0	SL*	TAD
0097					36,3355	57576 1		0,2
0098	REP	3	LAST	1223	36,3356	01257 0		TRIPA
0099					36,3357	63101 1	NORM	INCR,2
0100	REP	27	LAST	1091	36,3360	00050 1		X2
0101					36,3361	77775 1	DEC	-2
0102					36,3362	77134 1	SXA,2	AXT,2
0103	REP	2	LAST	87	36,3363	02215 0		NORMGAM
0104					36,3364	00242 0		162D
0105					36,3365	40265 1	BDDV	SETPD
0106	REP	4	LAST	566	36,3366	15322 0		DP1/4TH
0107					36,3367	00001 0		0
0108	REP	2	LAST	119	36,3370	03456 0	STORE	GAMMA
0109					36,3371	60351 0	TLOAD	NORM
0110	REP	4	LAST	1224	36,3372	01257 0		TRIPA
0111	REP	56	LAST	1163	36,3373	00047 1		X1
0112					36,3374	65345 0	DLOAD	PDDL
0113	REP	649	LAST	1218	36,3375	00155 0		MPAC
0114	REP	5	LAST	617	36,3376	03524 1		DELTAQ
0115					36,3377	77701 1	NORM	
0116	REP	40	LAST	1222	36,3400	00051 0		S1
0117					36,3401	70460 1	XSU,1	SR1
0118	REP	41	LAST	1224	36,3402	00050 1		S1
0119					36,3403	41471 0	DDV	PUSH
01193					36,3404	77650 1	GOTO	
01196	REP	1			36,3405	77676 0		NEWZCOMP
0120					36,3406	77731 1	-3 SSP	
0121	REP	15	LAST	1222	36,3407	00052 0		S2
0122					36,3410	00066 1		54D
0123					36,3411	60775 1	INCOR2 VLOAD	VXM*
0124	REP	11	LAST	1223	36,3412	02723 0		ZI
0125	REP	61	LAST	1223	36,3413	75134 0		W +162D,2
0126					36,3414	77206 0	PUSH	VLOAD
0127	REP	12	LAST	1224	36,3415	02731 0		ZI +6
0128					36,3416	53303 1	VXM*	VAD
0129	REP	62	LAST	1224	36,3417	75112 1		W +180D,2
0130					36,3420	77206 0	PUSH	VLOAD
0131	REP	13	LAST	1224	36,3421	02737 0		ZI +12D
0132					36,3422	53303 1	VXM*	VAD
0133	REP	63	LAST	1224	36,3423	75070 1		W +198D,2
0134					36,3424	61006 0	PUSH	TIX,2
0135	REP	1			36,3425	75411 1		INCOR2
0136					36,3426	45575 1	VLOAD	STADR
0137	REP	2	LAST	119	36,3427	74303 1	STORE	OMEGA +12D
0138					36,3430	45575 1	VLOAD	STADR
0139	REP	3	LAST	1224	36,3431	74311 1	STORE	OMEGA +6
0140					36,3432	45575 1	VLOAD	STADR
0141	REP	4	LAST	1224	36,3433	74317 1	STORE	OMEGA

NORMALIZATION COUNT -2 FOR GAMMA

PD $0-1$ = NORM (A)

PD $0-1$ = DELTAQ/A

COMPUTE OMEGA$_{1,2,3}$

PD $2-7$=OMEGA$_1$, $8-13$=OMEGA$_2$, $14-19$=OMEGA$_3$

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0142				36,3434	77214 0		BON	VLOAD	
0143	REP	9	LAST 1223	36,3435	02706 1			DMENFLG	
0144	REP	1		36,3436	75441 1			INCOR2AB	
0145	REP	21	LAST 1223	36,3437	15332 1			ZEROVECS	
0146	REP	5	LAST 1224	36,3440	03474 0		STORE	OMEGA +12D	
0147				36,3441	66374 1	INCOR2AB	AXT,2	SSP	
0148				36,3442	00022 1			18D	
0149	REP	16	LAST 1224	36,3443	00052 0			S2	
0150				36,3444	00006 1			6	
0151				36,3445	77773 1	INCOR3	VLOAD*		
0152	REP	6	LAST 1225	36,3446	74275 1			OMEGA +18D,2	
0153				36,3447	53761 1		VXSC	VSL*	
0154				36,3450	00001 0			0	DELTAQ/A
0155				36,3451	20201 0			0,1	
0156	REP	12	LAST 617	36,3452	11301 0		STORE	DELTAX +18D,2	
0157				36,3453	77304 0		TIX,2	VLOAD	
0158	REP	1		36,3454	75445 0			INCOR3	
0159	REP	13	LAST 1225	36,3455	01265 1			DELTAX +6	
0160				36,3456	77732 1		VSL3		
0161	REP	14	LAST 1225	36,3457	01265 1		STORE	DELTAX +6	
0162				36,3460	77650 1		GOTO		
0163	REP	11	LAST 1222	36,3461	02317 0			EGRESS	

```
P0164    INCORP2 -INCORPORATES THE COMPUTED STATE VECTOR DEVIATIONS INTO THE
R0165    ESTIMATED STATE VECTOR. THE STATE VECTOR UPDATED MAY BE FOR EITHER THE
R0166    LEM OR THE CSM,DETERMINED BY FLAG VEHUPFLG.(ZERO = LEM) (1 = CSM)
R0167    INPUT
R0168       PERMANENT STATE VECTOR FOR EITHER THE LEM OR CSM
R0169       VEHUPFLG =  UPDATE VEHICLE 0=LEM   1=CSM
R0170       W =        ERROR TRANSITION MATRIX
R0171       DELTAX  =  COMPUTED STATE VECTOR DEVIATIONS
R0172       DMENFLG =  SIZE OF W MATRIX (ZERO =6X6) (1=9X9)
R0173       GAMMA   =  SCALAR FOR INCORPORATION
R0174       ZI      =  VECTOR USED IN INCORPORATION
R0175       OMEGA   =  WEIGHTING VECTOR

R0176    OUTPUT
R0177       UPDATED PERMANENT STATE VECTOR

R0178    CALLING SEQUENCE
R0179       L   CALL  INCORP2

R0180    NORMAL EXIT
R0181       L+1 OF CALLING SEQUENCE
```

0182	REP	1		36,2000			SETLOC	MEASINC1
0183				36,3462			BANK	
0184	REP	2 LAST 1222 TO 1226'	138	136*			COUNT*	ss/INCOR
0185				36,3462	45020 1	INCORP2	STO	CALL
0186	REP	12 LAST 1225		36,3463	02317 0			EGRESS
0187	REP	21 LAST 868		36,3464	27371 1			INTSTALL
0188				36,3465	74375 0		VLOAD	VXSC CALC. GAMMA * OMEGA1,2,3
0189	REP	7 LAST 1225		36,3466	03460 0			OMEGA
0190	REP	3 LAST 1224		36,3467	03456 0			GAMMA
0191	REP	2 LAST 95		36,3470	26643 1		STOVL	OMEGAM1
0192	REP	8 LAST 1226		36,3471	03466 0			OMEGA +6
0193				36,3472	77761 1		VXSC	
0194	REP	4 LAST 1226		36,3473	03456 0			GAMMA
0195	REP	2 LAST 95		36,3474	26651 1		STOVL	OMEGAM2
0196	REP	9 LAST 1226		36,3475	03474 0			OMEGA +12D
0197				36,3476	77761 1		VXSC	
0198	REP	5 LAST 1226		36,3477	03456 0			GAMMA
0199	REP	2 LAST 95		36,3500	02657 1		STORE	OMEGAM3
0200				36,3501	77776 1		EXIT	
0201	REP	1		36,3502	3 3763 0		CAF	54DO INITIAL IX 1 SETTING FOR W MATRIX
0202	REP	2 LAST 78		36,3503	55∝252 1		TS	WIXA
0203	REP	2 LAST 76		36,3504	55∝253 0		TS	WIXB
0204	REP	249 LAST 1201		36,3505	3 4714 1		CAF	ZERO
0205	REP	2 LAST 76		36,3506	55∝254 1		TS	ZIXA INITIAL IX 2 SETTING FOR Z COMPONENT
0206	REP	2 LAST 76		36,3507	55∝255 0		TS	ZIXB
0207	REP	91 LAST 1051		36,3510	0 5301 0	FAZA	TC	PHASCHNG

0208					36,3511	04022 0		OCT	04022	
0209	REF	46	LAST	783	36,3512	0 5435 0		TC	UPFLAG	
0210	REF	2	LAST	503	36,3513	00236 0		ADRES	REINTFLG	
0212	REF	3	LAST	1226	36,3514	3 1253 1	FAZA1	CA	WIXB	START FIRST PHASE OF INCORP2
0213	REF	3	LAST	1226	36,3515	55*252 1		TS	WIXA	TO UPDATE 6 OR 9 DIM. W MATRIX IN TEMP
0214	REF	3	LAST	1226	36,3516	3 1255 1		CA	ZIXB	
0215	REF	3	LAST	1226	36,3517	55*254 1		TS	ZIXA	
0216	REF	228	LAST	1098	36,3520	0 6006 1		TC	INTPRET	
0217					36,3521	73150 1		LXA,1	LXA,2	
0218	REF	4	LAST	1227	36,3522	01252 0			WIXA	
0219	REF	4	LAST	1227	36,3523	01254 0			ZIXA	
0220					36,3524	70731 0		SSP	DLOAD*	
0221	REF	42	LAST	1224	36,3525	00051 0			S1	
0222					36,3526	00006 1			6	
0223	REF	14	LAST	1224	36,3527	75054 1			ZI,2	
0224					36,3530	60276 1		DCOMP	NORM	CALC UPPER 3X9 PARTITION OF W MATRIX
0225	REF	17	LAST	1225	36,3531	00052 0			S2	
0226					36,3532	65161 1		VXSC	XCHX,2	
0227	REF	3	LAST	1226	36,3533	02643 1			OMEGAM1	
0228	REF	18	LAST	1227	36,3534	00051 0			S2	
0229					36,3535	57144 1		LXC,2	XAD,2	
0230	REF	28	LAST	1224	36,3536	00047 1			X2	
0231	REF	3	LAST	1224	36,3537	02215 0			NORMGAM	
0232					36,3540	65057 0		VSL*	XCHX,2	
0233					36,3541	57576 1			0,2	
0234	REF	19	LAST	1227	36,3542	00051 0			S2	
0235					36,3543	77653 1		VAD*		
0236	REF	64	LAST	1224	36,3544	02467 0			W +54D,1	
0237	REF	2	LAST	95	36,3545	02665 0		STORE	HOLDW	
0238					36,3546	57543 1		DLOAD*	DCOMP	CALC MIDDLE 3X9 PARTITION OF W MATRIX
0239	REF	15	LAST	1227	36,3547	75054 1			ZI,2	
0240					36,3550	74301 0		NORM	VXSC	
0241	REF	20	LAST	1227	36,3551	00052 0			S2	
0242	REF	3	LAST	1226	36,3552	02651 1			OMEGAM2	
0243					36,3553	71124 0		XCHX,2	LXC,2	
0244	REF	21	LAST	1227	36,3554	00051 0			S2	
0245	REF	29	LAST	1227	36,3555	00047 1			X2	
0246					36,3556	53674 1		XAD,2	VSL*	
0247	REF	4	LAST	1227	36,3557	02215 0			NORMGAM	
0248					36,3560	57576 1			0,2	
0249					36,3561	52724 1		XCHX,2	VAD*	
0250	REF	22	LAST	1227	36,3562	00051 0			S2	
0251	REF	65	LAST	1227	36,3563	02555 0			W +108D,1	
0252	REF	3	LAST	1227	36,3564	02673 0		STORE	HOLDW +6	
0253					36,3565	77614 1		BOFF		
0254	REF	10	LAST	1225	36,3566	02746 0			DMENFLG	BRANCH IF 6 DIMENSIONAL
0255	REF	1			36,3567	75607 1			FAZB	
0256					36,3570	57543 1		DLOAD*	DCOMP	CALC LOWER 3X9 PARTITION OF W MATRIX
0257	REF	16	LAST	1227	36,3571	75054 1			ZI,2	
0258					36,3572	74301 0		NORM	VXSC	

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Line	REF		LAST	Address	Code	Label	Op	Operand
0259	REF	23	LAST 1227	36,3573	00052 0			S2
0260	REF	3	LAST 1226	36,3574	02657 1			OMEGAM3
0261				36,3575	71124 0		XCHX,2	LXC,2
0262	REF	24	LAST 1228	36,3576	00051 0			S2
0263	REF	30	LAST 1227	36,3577	00047 1			X2
0264				36,3600	53674 1		XAD,2	VSL*
0265	REF	5	LAST 1227	36,3601	02215 0			NORMGAM
0266				36,3602	57576 1			0,2
0267				36,3603	52724 1		XCHX,2	VAD*
0268	REF	25	LAST 1228	36,3604	00051 0			S2
0269	REF	66	LAST 1227	36,3605	02643 1			W +162D,1
0270	REF	4	LAST 1227	36,3606	02701 0		STORE	HOLDW +12D
0271				36,3607	77624 1	FAZB	CALL	
0272	REF	18	LAST 617	36,3610	56741 0			GRP2PC
0273				36,3611	77776 1		EXIT	
0274	REF	5	LAST 1227	36,3612	3 1252 0	FAZB1	CA	WIXA
0275	REF	1		36,3613	6 3764 1		AD	6DD
0276	REF	4	LAST 1227	36,3614	55=253 0		TS	WIXB
0277	REF	5	LAST 1227	36,3615	3 1254 0		CA	ZIXA
0278	REF	2	LAST 186	36,3616	6 7715 0		AD	MINUS2
0279	REF	4	LAST 1227	36,3617	55=255 0		TS	ZIXB
0280	REF	229	LAST 1227	36,3620	0 6006 1		TC	INTPRET
0281				36,3621	66350 1		LXA,1	SSP
0282	REF	6	LAST 1228	36,3622	01252 0			WIXA
0283	REF	43	LAST 1227	36,3623	00051 0			S1
0284				36,3624	00006 1			6
0285				36,3625	77775 1		VLOAD	
0286	REF	5	LAST 1228	36,3626	02665 0			HOLDW
0287	REF	67	LAST 1228	36,3627	06467 1		STORE	W +54D,1
0288				36,3630	77775 1		VLOAD	
0289	REF	6	LAST 1228	36,3631	02673 1			HOLDW +6
0290	REF	68	LAST 1228	36,3632	06555 1		STORE	W +108D,1
0291				36,3633	77214 0		BOFF	VLOAD
0292	REF	11	LAST 1227	36,3634	02746 0			DMENFLG
0293	REF	1		36,3635	75645 1			FAZB5
0294	REF	7	LAST 1228	36,3636	02701 0			HOLDW +12D
0295	REF	69	LAST 1228	36,3637	06643 1		STORE	W +162D,1
0296				36,3640	52100 1	FAZB2	TIX,1	GOTO
0297				36,3641	75643 1			+2
0298	REF	1		36,3642	75653 0			FAZC
0299				36,3643	77634 0		RTB	
0300	REF	1		36,3644	75510 1			FAZA
0301				36,3645	43335 0	FAZB5	SLOAD	DAD
0302	REF	5	LAST 1228	36,3646	01256 1			ZIXB
0303	REF	1		36,3647	35766 0			12DD
0304				36,3650	52030 0		BHIZ	GOTO
0305	REF	2	LAST 1228	36,3651	75653 0			FAZC
0306	REF	1		36,3652	75640 1			FAZB2
0307				36,3653	77624 1	FAZC	CALL	
0308	REF	19	LAST 1228	36,3654	56741 0			GRP2PC

START 2ND PHASE OF INCORP2 TO TRANSFER TEMP REG TO PERM W MATRIX

DONE WITH W MATRIX. UPDATE STATE VECTOR

L   MEASUREMENT INCORPORATION   USER=S PAGE NO.   8   E5 53

0309					36,3655	53375 0		VLOAD	VAD	START 3RD PHASE OF INCORP2
0310	REP	8	LAST	600	36,3656	01701 0			X789	7TH,8TH,9TH,COMPONENT OF STATE VECTOR
0311	REP	15	LAST	1225	36,3657	01273 0			DELTAX +12D	INCORPORATION FOR X789
0312	REP	2	LAST	119	36,3660	03450 0		STORE	TX789	
0313					36,3661	47014 1		BON	RTB	
0314	REP	13	LAST	617	36,3662	00707 1			VEHUPFLG	
0315	REP	1			36,3663	75753 1			DOCSM	
0316	REP	1			36,3664	26745 0			MOVEPLEM	
0317					36,3665	77004 0	PAZAB	BOVB	AXT,2	
0318	REP	9	LAST	679	36,3666	57343 1			TCDANZIG	
0319					36,3667	00000 1			0	
0320					36,3670	77014 1		BOFF	AXT,2	
0321	REP	8	LAST	573	36,3671	04343 1			MOONTHIS	
0322					36,3672	75674 0			+2	
0323					36,3673	00002 0			2	
0324					36,3674	53775 1		VLOAD	VSR*	
0325	REP	16	LAST	1229	36,3675	01257 0			DELTAX	B_{27} IF MOON ORBIT, B_{29} IF EARTH
0326					36,3676	57205 1			0 -7,2	
0327					36,3677	40055 0		VAD	BOV	
0328	REP	4	LAST	284	36,3700	01521 0			TDELTAV	
0329	REP	1			36,3701	75713 0			PAZAB1	
0330	REP	5	LAST	1229	36,3702	25521 0		STOVL	TDELTAV	
0331	REP	17	LAST	1229	36,3703	01265 1			DELTAX +6	B_5 IF MOON ORBIT, B_7 IF EARTH
0332					36,3704	53257 1		VSR*	VAD	
0333					36,3705	57202 0			0 -4,2	
0334	REP	4	LAST	285	36,3706	01527 0			TNUV	
0335					36,3707	77600 1		BOV		
0336	REP	1			36,3710	75717 1			PAZAB2	
0337	REP	5	LAST	1229	36,3711	35527 1		STCALL	TNUV	
0338	REP	1			36,3712	75726 0			PAZAB3	
0339					36,3713	53375 0	PAZAB1	VLOAD	VAD	
0340	REP	12	LAST	666	36,3714	01535 0			RCV	
0341	REP	16	LAST	1229	36,3715	01257 0			DELTAX	
0342	REP	13	LAST	1229	36,3716	01535 0		STORE	RCV	
0343					36,3717	53375 0	PAZAB2	VLOAD	VAD	
0344	REP	11	LAST	868	36,3720	01543 1			VCV	
0345	REP	19	LAST	1229	36,3721	01265 1			DELTAX +6	
0346	REP	12	LAST	1229	36,3722	01543 1		STORE	VCV	
0347					36,3723	45134 0		SXA,2	CALL	
0348	REP	3	LAST	259	36,3724	02150 1			PBODY	
0349	REP	1			36,3725	23344 0			RECTIFY	
03491					36,3726	77624 1	PAZAB3	CALL		
03492	REP	20	LAST	1228	36,3727	56741 0			GRP2PC	
0350					36,3730	47014 1		BON	RTB	
0351	REP	14	LAST	1229	36,3731	00707 1			VEHUPFLG	
0352	REP	1			36,3732	75756 1			DOCSM1	
0353	REP	1			36,3733	26724 1			MOVEALEM	
0354					36,3734	77624 1		CALL		
0355	REP	2	LAST	259	36,3735	20263 1			SVDWN2	STORE DOWNLINK STATE VECTOR
0356					36,3736	77624 1	PAZAB4	CALL		

0357	REP	21	LAST 1229	36,3737	56741 0			GRP2PC	PHASE CHANGE
0358				36,3740	77214 0		BOFF	VLOAD	
0359	REP	12	LAST 1228	36,3741	02746 0			DMENFLG	
0360	REP	1		36,3742	75745 0			FAZAB5	6 DIMENSIONAL
0361	REP	3	LAST 1229	36,3743	03450 0			TX769	9 DIMENSIONAL
0362	REP	9	LAST 1229	36,3744	01701 0		STORE	X769	
0363				36,3745	66150 0	FAZAB5	LXA,1	SXA,1	
0364	REP	13	LAST 1228	36,3746	02317 0			EGRESS	
0365	REP	20	LAST 1166	36,3747	00052 0			QPRET	
0366				36,3750	77776 1		EXIT		
0367	REP	60	LAST 1039	36,3751	0 4574 0		TC	POSTJUMP	EXIT
0368	REP	3	LAST 624	36,3752	27406 0		CADR	INTWAKE	
0369				36,3753	52034 1	DOCSM	RTB	GOTO	
0370	REP	1		36,3754	26700 1			MOVEPCSM	
0371	REP	1		36,3755	75665 0			FAZAB	
0372				36,3756	45034 1	DOCSM1	RTB	CALL	
0373	REP	2	LAST 32	36,3757	26651 1			MOVEACSM	
0374	REP	2	LAST 259	36,3760	20237 0			SVDWN1	STORE DOWNLINK STATE VECTOR
0375				36,3761	77650 1		GOTO		
0376	REP	1		36,3762	75736 1			FAZAB4	
0377	REP	22	LAST 1225	26,3331		ZEROO	=	ZEROVECS	
0378				36,3763	00066 1	54DD	DEC	54	
0379				36,3764	77771 0	6DD	DEC	-6	
0380				36,3765	00014 1	12DD	DEC	12	
0400	REP	2	LAST 562	37,2000			SETLOC	RENDEZ	
0401				37,3676			BANK		
0402	REP	1					COUNT*	$$/INCOR	
0403				37,3676	51575 1	NEWZCOMP	VLOAD	ABVAL	
0404	REP	17	LAST 1227	37,3677	02723 0			ZI	
0405	REP	1		37,3700	24045 0		STOVL	NORMZI	
0406	REP	16	LAST 1230	37,3701	02731 0			ZI +6	
0407				37,3702	41446 1		ABVAL	PUSH	
0408				37,3703	50025 0		DSU	PMN	
0409	REP	2	LAST 1230	37,3704	00045 0			NORMZI	
0410				37,3705	77710 1			+3	
0411				37,3706	45545 1		DLOAD	STADR	
0412	REP	3	LAST 1230	37,3707	77732 1		STORE	NORMZI	
0413				37,3710	51575 1		VLOAD	ABVAL	
0414	REP	19	LAST 1230	37,3711	02737 0			ZI +12D	
0415				37,3712	45206 1		PUSH	DSU	
0416	REP	4	LAST 1230	37,3713	00045 0			NORMZI	
0417				37,3714	71240 1		BMN	DLOAD	
0418				37,3715	77720 1			+3	
0419				37,3716	77626 0		STADR		
0420	REP	5	LAST 1230	37,3717	77732 1		STORE	NORMZI	LARGEST ABVAL
0421				37,3720	66145 1		DLOAD	SXA,1	
0422	REP	6	LAST 1230	37,3721	00045 0			NORMZI	
0423	REP	7	LAST 1230	37,3722	00044 1			NORMZI	SAVE X1
0424				37,3723	62101 0		NORM	INCR,1	

L   MEASUREMENT INCORPORATION

0425	REP	57	LAST	1224	37,3724	00047 1		X1	
0426					37,3725	00002 0	DEC	2	
0427					37,3726	53775 1	VLOAD	VSL*	
0428	REP	20	LAST	1230	37,3727	02723 0		ZI	
0429					37,3730	20201 0		0,1	
0430	REP	21	LAST	1231	37,3731	26723 0	STOVL	ZI	
0431	REP	22	LAST	1231	37,3732	02731 0		ZI +6	
0432					37,3733	77657 0	VSL*		
0433					37,3734	20201 0		0,1	
0434	REP	23	LAST	1231	37,3735	26731 0	STOVL	ZI +6	
0435	REP	24	LAST	1231	37,3736	02737 0		ZI +12D	
0436					37,3737	66057 0	VSL*	SXA,1	
0437					37,3740	20201 0		0,1	
0438	REP	8	LAST	1230	37,3741	00045 0		NORMZI +1	SAVE SHIFT
0439	REP	25	LAST	1231	37,3742	02737 0	STORE	ZI +12D	
0440					37,3743	54150 1	LXA,1	XSU,1	
0441	REP.	6	LAST	1228	37,3744	02215 0		NORMGAM	
0442	REP	9	LAST	1231	37,3745	00045 0		NORMZI +1	
0443					37,3746	77660 1	XSU,1	.	
0444	REP	10	LAST	1231	37,3747	00045 0		NORMZI +1	
0445					37,3750	70130 1	SXA,1	LXC,1	
0446	REP	7	LAST	1231	37,3751	02215 0		NORMGAM	
0447	REP	11	LAST	1231	37,3752	00045 0		NORMZI +1	
0448					37,3753	40270 0	XAD,1	SETPD	
0449	REP	12	LAST	1231	37,3754	00044 1		NORMZI	
0450					37,3755	00003 1		2D	
0451					37,3756	77650 1	GOTO		
0452	REP	2	LAST	1224	37,3757	75406 1		INCOR2 -3	
0453					0044		NORMZI =	36D	

L   CONIC SUBROUTINES

P0001   PROGRAM DESCRIPTION - ENTIRE CONIC SUBROUTINE LOG SECTION
R0003   MOD NO. - 0
R0005   MOD BY KRAUSE
R0007
R0008   FUNCTIONAL DESCRIPTION -

DATE - 1 SEPTEMBER 1987
LOG SECTION - CONIC SUBROUTINES
ASSEMBLY - COLOSSUS REVISION 88

R0009   THE FOLLOWING SET OF SUBROUTINES SOLVE VARIOUS PROBLEMS INVOLVING THE TRAJECTORY PRODUCED BY A CENTRAL
R0011   INVERSE-SQUARE FORCE ACTING ON A POINT MASS, AS OUTLINED IN THE CMC AND LGC LUNAR LANDING MISSION GSOP, SECTION
R0013   5.5.1.2. A GENERAL USAGE POINT-OF-VIEW WAS TAKEN IN FORMULATING, MECHANIZING, AND SCALING THE SUBROUTINES,
R0015   RATHER THAN OPTIMIZING EACH FOR A PARTICULAR USE. THEREFORE, MULTIPLE USAGE CAN BE MADE OF THE SUBROUTINES
R0017   INVOLVING ANY REALISTIC SET OF CONSTRAINTS. IT SHOULD BE NOTED THAT ONLY ONE SET OF CODING IS USED, WHETHER THE
R0019   EARTH, MOON, OR ANY OTHER CELESTIAL BODY IS SPECIFIED AS THE CENTRAL BODY OF THE PROBLEM, PROVIDED ONE OBSERVES
R0021   THE INHERENT SCALE CHANGE REQUIRED IN POSITION, VELOCITY, MU, AND TIME, AS OUTLINED IN MISSION PROGRAMMING
R0023   DEFINITION MEMO NO. 10. THIS CAN BE ACCOMPLISHED BY SIMPLY ADDING TO THE MUTABLE AND INITIALIZING THE SUBROU-
R0025   TINES APPROPRIATELY.
R0026   DUE TO THE UNIFORMITY OF THE EQUATIONS INVOLVED, CODING WAS MINIMIZED BY TREATING INDIVIDUAL EQUATIONS AND
R0028   BLOCKS OF EQUATIONS AS SUBROUTINES OF LOWER RANK WHENEVER POSSIBLE. AS A RESULT, THREE BY-PRODUCTS SUBROUTINES,
R0030   DIRECTLY USABLE AS INDEPENDENT SUBROUTINES, WERE GENERATED.
R0031   RESTRICTIONS -

R0032   THE ONLY LIMITATION IN THE SCOPE OF PROBLEM WHICH CAN BE SOLVED BY A PARTICULAR SUBROUTINE IS THE SCALING
R0034   LIMIT OF EACH PARAMETER AS SPECIFIED IN THE GSOP. THESE SCALING LIMITS WERE CHOSEN SO THAT ALL FEASIBLE TRAJEC-
R0038   TORIES COULD BE HANDLED.
R0037   SINCE THE SUBROUTINES (EXCEPT KEPLER) USE COMMON SUBROUTINES OF LOWER RANK WHICH USE ERASABLE OTHER THAN
R0039   THE PUSHLIST (DUE TO ITS LIMITED SIZE) AND COMMON INTERPRETIVE SWITCHES, THE CONIC SUBROUTINES CANNOT BE ALLOWED
R0041   TO INTERRUPT EACH OTHER. IT IS UP TO THE USER TO GUARANTEE THIS CONDITION.
R0043

L   CONIC SUBROUTINES

P0044   PROGRAM DESCRIPTION - KEPLER SUBROUTINE
R0046   MOD NO. -1
R0048   MOD BY KRAUSE

DATE - 11 OCTOBER 1987
LOG SECTION - CONIC SUBROUTINES
ASSEMBLY - COLOSSUS 103 AND SUNDANCE 222

R0050
R0051   FUNCTIONAL DESCRIPTION -
R0052   THIS SUBROUTINE, GIVEN AN INITIAL STATE VECTOR AND THE DESIRED TRANSFER TIME THROUGH WHICH THE STATE IS TO
R0054   BE UPDATED ALONG A CONIC TRAJECTORY, COMPUTES THE NEW, UPDATED STATE VECTOR. THE TRAJECTORY MAY BE ANY CONIC
R0056   SECTION - CIRCULAR, ELLIPTIC, PARABOLIC, HYPERBOLIC, OR RECTILINEAR WITH RESPECT TO THE EARTH OR THE MOON. THE
R0058   USE OF THE SUBROUTINE CAN BE EXTENDED USING OTHER PRIMARY BODIES BY SIMPLE ADDITIONS TO THE MUTABLE WITHOUT
R0060   INTRODUCING ANY CODING CHANGES, ACCEPTING THE INHERENT SCALE FACTOR CHANGES IN POSITION AND VELOCITY. AN ITERA-
R0062   TION TECHNIQUE IS UTILIZED IN THE COMPUTATION.
R0063   IF A NEGATIVE TIME-OF-FLIGHT IS INPUT, THE PROGRAM WILL SOLVE FOR THE STATE WHICH WOULD BE PRODUCED BY
R0065   EXTRAPOLATING THE POSITION BACKWARD IN TIME.
R00651   IF THE DESIRED TRANSFER TIME IS POSITIVE AND EXCEEDS THE ORBITAL PERIOD, THE SUBROUTINE, THROUGH A MODULAR
R00853   TECHNIQUE, WILL COMPUTE THE STATE CORRESPONDING TO THE DESIRED TIME AS USUAL.
R0066

R0067   THE RESTRICTIONS ARE -
R0068   1. A NEGATIVE DESIRED TIME MUST BE LESS THAN ONE PERIOD IN MAGNITUDE. IF GREATER, THE ONE-PERIOD- SOLUTION
R0070   WILL BE RETURNED.
R0071   ·2. THE PARAMETERS IN THE PROBLEM CANNOT EXCEED THEIR SCALING LIMITS AS SPECIFIED IN THE GSOP. IF
R0073   ANY OF THESE LIMITS ARE EXCEEDED, THE RESULTING SOLUTION WILL BE MEANINGLESS.
R0075

R0076   THE NUMBER OF ITERATIONS AND, THEREFORE, THE COMPUTATION SPEED IS DEPENDENT ON THE ACCURACY OF THE
R0078   GUESS, XKEPNEW. THE AGC COMPUTATION TIME IS APPROXIMATELY .061 SECONDS FOR INITIALIZATION, .065 SECONDS FOR THE
R0080   FINAL COMPUTATIONS, PLUS .083 SECONDS FOR EACH ITERATION.
R0081
R0082   REFERENCES -
R0083   R-479, MISSION PROGRAMMING DEFINITION MEMO NO. 10, LUNAR LANDING MISSION GSOP, SECTION 5.5, SGA
R0085   MEMO 67-4.
R0086
R0087   INPUT - ERASABLE INITIALIZATION REQUIRED

R0088   * SCALE FACTOR *
R0089   VARIABLE*IN POWERS OF 2*   DESCRIPTION AND REMARKS
R0090   --------*--------------*   -----------------------
R0091   RRECT   * +29 FOR EARTH*DP INITIAL POSITION VECTOR IN METERS
R0092   * +27 FOR MOON *
R0093   VRECT   * +7 FOR EARTH *DP INITIAL VELOCITY VECTOR IN METERS/CENTISECOND
R0094   * +5 FOR MOON *
R0095   X1 (38D)* NONE   *INDEX REGISTER SET TO -2D OR -10D ACCORDING TO WHETHER THE EARTH OR MOON,
R0097   *   *RESPECTIVELY, IS THE CENTRAL BODY
R0098   TAU.   * +28   *DESIRED TRANSFER TIME IN CENTISECONDS (DP)

L   CONIC SUBROUTINES   USER=S PAGE NO.   3   Eo S3

R0099   XKEPNEW * +17 FOR EARTH*GUESS OF X IN METERS-TO-THE-ONE-HALF FROM KEPPREP
R0101   * +16 FOR MOON *(DP)
R0102   TC   * +28   *DP PREV. VALUE OF TIME IN CENTISECS FROM KEPPREP
R0103   XPREV   * +17 FOR EARTH*PREVIOUS VALUE OF X IN METERS-TO-THE-ONE-HALF POWER FROM KEPPREP (DP)
R0105   * +16 FOR MOON *(DP)
R0106
R0107   SUBROUTINES CALLED -
R0108   DELTIME
R0109
R0110   CALLING SEQUENCE AND NORMAL EXIT MODES -

R0111   KEPRTN-2 GOTO   MUST BE IN INTERPRETIVE MODE AND OVFIND MUST BE CLEAR
R0113   KEPRTN-1   KEPLER   RETURNS WITH XPREV IN MPAC. PL IS AT 0.
R0114   KEPRTN   ...   CONTINUE

R0115   KEPLER MUST NOT BE CALLED DIRECTLY SINCE AN INTERRUPTION OF IT WOULD DESTROY THE ERASABLES IT NEEDS TO COMPLETE
R0117   THE INTERRUPTED JOB. THEREFORE THE USER MUST CALL CSMCONIC OR LEMCONIC WHICH GUARANTEES NO INTERRUPTS AND WHICH
R0119   ALSO CALLS KEPPREP TO COMPUTE A GUESS OF XKEPNEW.
R0120
R0121   ABORT EXIT MODES -
R0122   NONE
R0123
R0124   OUTPUT -

R0125   * SCALE FACTOR *
R0126   VARIABLE*IN POWERS OF 2*   DESCRIPTION AND REMARKS
R0127   --------*---------------*   ------------------------
R0128   RCV   * +29 FOR EARTH*DP TERMINAL POSITION VECTOR IN METERS
R0129   * +27 FOR MOON *
R0130   VCV   * +7 FOR EARTH *DP TERMINAL VELOCITY VECTOR IN METERS/CENTISEC
R0131   * +5 FOR MOON *
R0132   TC   * +28   *DP TRANSFER TIME IN CENTISECS TO WHICH KEPLER CONVERGED.
R0134   XPREV   * +17 FOR EARTH*DP X IN METERS-TO-THE-ONE-HALF-POWER TO WHICH KEPLER CONVERGED.
R0136   * +16 FOR MOON *(DP)
R0137   FOR OTHER OUTPUT WHICH MAY BE OF USE, SEE DEBRIS.
R0138
R0139   DEBRIS -

R0140   PARAMETERS WHICH MAY BE OF USE -

L   CONIC SUBROUTINES

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R0141            * SCALE FACTOR *
R0142    VARIABLE*IN POWERS OF 2*                    DESCRIPTION AND REMARKS
R0143    --------*--------------*                    -----------------------
R0144    URRECT * +1              *DP UNIT VECTOR OF INITIAL POSITION
R0145    R1     * +29 FOR EARTH*DP MAGNITUDE OF INITIAL POSITION IN METERS
R0146           * +27 FOR MOON *
R0147    ALPHA  * -22 FOR EARTH*DP INVERSE OF SEMIMAJOR AXIS IN 1/METERS
R0148          * -20 FOR MOON *
R01481   TMODULO * +28           *DP INTEGRAL NUMBER OF PERIODS IN  CENTISECS. WHICH WAS SUBTRACTED FROM TAU. TO PRODUCE A
R01483           *               *TAU. OF LESS THAN ONE PERIOD.

R0149    PARAMETERS OF NO USE -
R0150    DP PARAMETERS - EPSILONT, DELX, DELT, RCNORM, XMODULO, PLUS PUSHLIST REGISTERS 0 THROUGH 39D.
R0152
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L   CONIC SUBROUTINES

P0153   PROGRAM DESCRIPTION - LAMBERT SUBROUTINE   DATE - 1 SEPTEMBER 1987
R0155   MOD NO. - 0   LOG SECTION - CONIC SUBROUTINES
R0157   MOD BY KRAUSE   ASSEMBLY - COLOSSUS REVISION 88
R0159
R0160   FUNCTIONAL DESCRIPTION -

R0161   THIS SUBROUTINE CALCULATES THE INITIAL VELOCITY REQUIRED TO TRANSFER A POINT-MASS ALONG A CONIC TRAJECTORY
R0163   FROM AN INITIAL POSITION TO A TERMINAL POSITION IN A PRESCRIBED TIME INTERVAL. THE RESULTING TRAJECTORY MAY BE
R0165   A SECTION OF A CIRCLE, ELLIPSE, PARABOLA, OR HYPERBOLA WITH RESPECT TO THE EARTH OR THE MOON. THE USE OF THE
R0167   SUBROUTINE CAN BE EXTENDED USING OTHER PRIMARY BODIES BY SIMPLE ADDITIONS TO THE MUTABLE WITHOUT INTRODUCING ANY
R0169   CODING CHANGES, ACCEPTING THE INHERENT SCALE FACTOR CHANGES IN POSITION AND VELOCITY. AN ITERATION TECHNIQUE IS
R0171   UTILIZED IN THE COMPUTATION.
R0172

R0173   THE RESTRICTIONS ARE -
R0174   1. RECTILINEAR TRAJECTORIES CANNOT BE COMPUTED.
R0175   2. AN ACCURACY DEGRADATION OCCURS AS THE COSINE OF THE TRUE ANOMALY DIFFERENCE APPROACHES +1.0.
R0177   3. THE ANGLE BETWEEN ANY POSITION VECTOR AND ITS VELOCITY VECTOR MUST BE GREATER THAN 1 DEGREE 47.5 MINUTES
R0179   AND LESS THAN 178 DEGREES 12.5 MINUTES.
R0180   4. NEGATIVE TRANSFER TIME IS AMBIGUOUS AND WILL RESULT IN NO SOLUTION.
R0182   5. THE PARAMETERS IN THE PROBLEM MUST NOT EXCEED THEIR SCALING LIMITS SPECIFIED IN THE GSOP. IF THE
R0184   LIMITS ARE EXCEEDED, THE RESULTING SOLUTION WILL BE MEANINGLESS.
R0185   THE NUMBER OF ITERATIONS AND, THEREFORE, THE COMPUTATIONS SPEED IS DEPENDENT ON THE ACCURACY OF THE FIRST
R0187   GUESS OF THE INDEPENDENT VARIABLE, COGA.   THE AGC COMPUTATION TIME IS APPROXIMATE-
R0189   LY .105 SECONDS FOR INITIALIZATION, .089 SECONDS FOR FINAL COMPUTATIONS, PLUS .205 SECONDS FOR EACH ITERATION.
R0191
R0192   REFERENCES -
R0193   R-479, MISSION PROGRAMMING DEFINITION MEMO NO. 10, LUNAR LANDING MISSION GSOP-SECTION 5.5, SGA MEMO 67-8,
R0195   SGA MEMO 87-4.
R0196
R0197   INPUT - ERASABLE INITIALIZATION REQUIRED

R0198   * SCALE FACTOR *
R0199   VARIABLE*IN POWERS OF 2*   DESCRIPTION AND REMARKS
R0200   --------*--------------*   -------------------------
R0201   R1VEC   * +29 FOR EARTH*DP INITIAL POSITION VECTOR IN METERS
R0202   * +27 FOR MOON *
R0203   R2VEC   * +29 FOR EARTH*DP TARGET OR TERMINAL POSITION VECTOR IN METERS
R0204   * +27 FOR MOON *
R0205   TDESIRED* +28   *DP DESIRED TRANSFER TIME IN CENTISECONDS
R0208   X1 (38D)* NONE   *INDEX REGISTER SET TO -2D OR -10D ACCORDING TO WHETHER THE EARTH OR MOON,
R0208   *   *RESPECTIVELY, IS THE CENTRAL BODY
R0209   GEOMSGN * NONE   *SP +.5 IF DESIRED TRANSFER ANGLE IS LESS THAN 180 DEGREES, -.5 IF GREATER THAN 180 DEG.
R0211   GUESSW * NONE   *AN INTERPRETER SWITCH TO BE SET IF NO GUESS OF COGA IS AVAILABLE, CLEAR IF A GUESS OF

L   CONIC SUBROUTINES

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R0213              *                 *COGA IS TO BE USED BY LAMBERT
R0214    COGA      * +5               *DP GUESS OF COTANGNT OF FLIGHT PATH ANGLE (MEASURED FROM VERTICAL).  THIS WILL BE
R0216              *                  *IGNORED IF GUESSW IS SET.
R0217    NORMSW   * NONE              *AN INTERPRETER SWITCH TO BE SET IF UN IS TO BE AN INPUT TO THE SUBROUTINE, CLEAR IF
R0219              *                  *LAMBERT IS TO COMPUTE ITS OWN NORMAL (UN).
R0220    UN        * +1               *DP UNIT NORMAL TO THE DESIRED ORBIT PLANE IN THE DIRECTION OF THE RESULTING ANGULAR
R0222              *                  *MOMENTUM VECTOR.  THIS WILL BE IGNORED IF NORMSW IS CLEAR.
R0224    VTARGTAG* NONE               *A S.P. TAG TO BE SET TO ZERO IF LAMBERT IS TO COMPUTE THE VELOCITY AT R2VEC AS WELL AS
R0226              *                  *AT R1VEC.
R0227
R0228    SUBROUTINES CALLED -
R0229        GEOM, GETX, DELTIME, ITERATOR, LAMENTER (PART OF NEWSTATE)
R0230
R0231 . CALLING SEQUENCE AND NORMAL EXIT MODES -

R0232    L        CALL                MUST BE IN INTERPRETIVE MODE AND OVFIND MUST BE CLEAR
R0234    L+1              LAMBERT     RETURNS WITH PL AT 0 AND WITH VVEC IN MPAC IF VTARGTAG WAS NON-ZERO OR VTARGET
R0236                                 IN MPAC IF VTARGTAG WAS ZERO
R0237    L+2      BON                 CONTINUE IF SOLNSW CLEAR SINCE SOLUTION IS ACCEPTABLE
R0239    L+3              SOLNSW
R0240    L+4              LAMABORT
R0241        IF A LAMBERT RESULT IS TO BE A FIRST GUESS FOR THE NEXT LAMBERT CALCULATION, COGA MUST BE PRESERVED AND
R0243    GUESSW MUST BE CLEAR FOR EACH SUCCEEDING LAMBERT CALL.
R0244
R0245    ABORT EXIT MODES -
R0246        IF SOLNSW WAS SET UPON EXITING, EITHER LAMBERT WAS ASKED TO COMPUTE A TRANSFER TOO NEAR 0 OR 360 DEG, OR T
R0248    WAS TOO SMALL TO PRODUCE A REALISTIC TRANSFER BETWEEN R1VEC AND R2VEC.  IN EITHER CASE THE FIX MUST BE MADE
R0250    ACCORDING TO THE NEEDS OF THE PARTICULAR USER.  THE ABORT EXIT MODE MAY BE CODED AS ...
R0252    LAMABORT DLOAD ABS           A MEASURE OF PROXIMITY TO 0 OR
R0253              1-CSTH             360 DEGREES.
R0254        DSU   BMN
R0255              ONEBIT
R0256              CHANGER2           CHANGE R2VEC DIRECTION SLIGHTLY.
R0257        DLOAD DAD
R0258              TDESIRED
R0259              SOMETIME
R0260        STCALL TDESIRED          INCREASE TDESIRED
R0261              LAMBERT
R0262
R0263    OUTPUT -
R0264              * SCALE FACTOR *
R0265    VARIABLE*IN POWERS OF 2*                           DESCRIPTION AND REMARKS
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R0266      --------+-------------*              -----------------------
R0267    VVEC   * +7 FOR EARTH *DP INITIAL VELOCITY VECTOR IN METERS/CENTISECOND REQUIRED TO SATISFY THE BOUNDARY VALUE
R0269           * +5 FOR MOON  *PROBLEM.
R0270    VTARGET * +7 FOR EARTH *DP RESULTANT VELOCITY VECTOR AT R2VEC IN METERS/CENTISECOND.
R0272           * +5 FOR MOON  *
R0273    SOLNSW * NONE          *INTERPRETER SWITCH WHICH IS SET IF THE SUBROUTINE CANNOT SOLVE THE PROBLEM, CLEAR IF THE
R0275           *               *SOLUTION EXISTS.
R0276    FOR OTHER OUTPUT WHICH MAY BE OF USE, SEE DEBRIS.
R0277
R0278    DEBRIS -
R0279         PARAMETERS WHICH MAY BE OF USE -

R0280           * SCALE FACTOR *
R0281    VARIABLE*IN POWERS OF 2*                        DESCRIPTION AND REMARKS
R0282    --------+-------------*              -----------------------
R0283    SNTH   * +1            *DP SIN OF ANGLE BETWEEN R1VEC AND R2VEC
R0284    CSTH   * +1            *DP COSINE OF ANGLE
R0285    1-CSTH * +2            *DP 1-CSTH
R0286    COGA   * +5            *DP COTAN OF INITIAL REQUIRED FLIGHT PATH ANGLE MEASURED FROM VERTICAL
R0289    P      * +4            *DP RATIO  OF SEMILATUS RECTUM TO INITIAL RADIUS
R0290    R1A    * +6            *DP RATIO OF INITIAL RADIUS TO SEMIMAJOR AXIS
R0291    R1 (32D)* +29 FOR EARTH*DP INITIAL RADIUS IN METERS
R0292           * +27 FOR MOON  *
R0293    UR1    * +1            *DP UNIT VECTOR OF R1VEC
R0294    U2     * +1            *DP UNIT VECTOR OF R2VEC

R0295         PARAMETERS OF NO USE
R0296    DP PARAMETERS - EPSILONL, CSTH-RHO, TPREV, TERRLAMB, R2, RTNLAMB (SP),   PLUS PUSHLIST REGISTER 0 THROUGH 41D
R0298    ADDITIONAL INTERPRETIVE SWITCHES USED - INFINFLG, 360SW, SLOPESW, ORDERSW
R0300
```

L   CONIC SUBROUTINES

P0301 PROGRAM DESCRIPTION - TIME-THETA SUBROUTINE
R0303 MOD NO. - 0
R0305 MOD BY KRAUSE
R0307
R0308 FUNCTIONAL DESCRIPTION -

R0309   THIS SUBROUTINE, GIVEN AN INITIAL STATE VECTOR AND A DESIRED TRUE-ANOMALY-DIFFERENCE THROUGH WHICH THE
R0311 STATE IS TO BE UPDATED ALONG A CONIC TRAJECTORY, CALCULATES THE CORRESPONDING TIME-OF-FLIGHT AND, IN ADDITION,
R0313 PROVIDES THE OPTION OF COMPUTING THE NEW UPDATED STATE VECTOR. THE RESULTING TRAJECTORY MAY BE A SECTION OF A
R0315 CIRCLE, ELLIPSE, PARABOLA, OR HYPERBOLA WITH RESPECT TO THE EARTH OR THE MOON. THE USE OF THE SUBROUTINE CAN BE
R0317 EXTENDED USING OTHER PRIMARY BODIES BY SIMPLE ADDITIONS TO THE MUTABLE WITHOUT INTRODUCING ANY CODING CHANGES,
R0319 ACCEPTING THE INHERENT SCALE FACTOR CHANGES IN POSITION AND VELOCITY.
R0320

R0321 THE RESTRICTIONS ARE -
R0322   1. THE ANGLE BETWEEN ANY POSITION VECTOR AND ITS VELOCITY VECTOR MUST BE GREATER THAN 1 DEGREE 47.5 MINUTES
R0324 AND LESS THAN 178 DEGREES 12.5 MINUTES.
R0325   2. THE PARAMETERS IN THE PROBLEM MUST NOT EXCEED THEIR SCALING LIMITS SPECIFIED IN THE GSOP. IF THE LIMITS
R0327 ARE EXCEEDED, THE RESULTING SOLUTION WILL BE MEANINGLESS.

R0328   THE AGC COMPUTATION TIME IS APPROXIMATELY .292 SECONDS.
R0329
R0330 REFERENCES -
R0331   R-479, MISSION PROGRAMMING DEFINITION MEMO NO. 10, LUNAR LANDING MISSION GSOP-SECTION 5.5, SGA MEMO 67-8.
R0333
R0334 INPUT - ERASABLE INITIALIZATION REQUIRED

R0335   * SCALE FACTOR *
R0336 VARIABLE*IN POWERS OF 2*   DESCRIPTION AND REMARKS
R0337 --------*--------------*   -----------------------
R0338 RVEC   * +29 FOR EARTH*DP INITIAL POSITION VECTOR IN METERS
R0339   * +27 FOR MOON *
R0340 VVEC   * +7 FOR EARTH *DP INITIAL VELOCITY VECTOR IN METERS/CENTISECOND
R0341   * +5 FOR MOON *
R0342 SNTH   * +1   *DP SINE OF TRUE-ANOMALY-DIFFERENCE THROUGH WHICH THE STATE IS TO BE UPDATED
R0344 CSTH   * +1   *DP COSINE OF THE ANGLE
R0345 RVSW   * NONE   *AN INTERPRETIVE SWITCH TO BE SET IF ONLY TIME IS TO BE AN OUTPUT, CLEAR IF THE NEW STATE
R0347   *   *IS TO BE COMPUTED ALSO.
R0348 X1 (38D)*NONE   *INDEX REGISTER TO BE SET TO -2D OR -10D ACCORDING TO WHETHER THE EARTH OR MOON,
R0350   *   *RESPECTIVELY, IS THE CENTRAL BODY.
R0351
R0352 SUBROUTINES CALLED -

L   CONIC SUBROUTINES   USER-3 PAGE NO.   9   E0 S3

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R0353        PARAM, GEOM, GETX, DELTIME, NEWSTATE
R0354
R0355    CALLING SEQUENCE AND NORMAL EXIT MODES -

R0356        IF ONLY TIME IS DESIRED AS OUTPUT -
R0357    L         SET    CALL          MUST BE IN INTERPRETIVE MODE AND OVFIND MUST BE CLEAR
R0359    L+1              RVSW
R0360    L+2              TIMETHET       RETURN WITH PL AT 0 AND T IN MPAC
R0361    L+3              ...            CONTINUE
R0362

R0363        IF THE UPDATE STATE VECTOR IS DESIRED AS WELL -
R0364    L         CLEAR  CALL          MUST BE IN INTERPRETIVE MODE AND OVFIND MUST BE CLEAR
R0366    L+1              RVSW
R0367    L+2              TIMETHET       RETURNS WITH PL AT 6.  THE INITIAL POSITION VECTOR IS IN 0D OF THE PUSHLIST AND
R0369                                   THE INITIAL VELOCITY VECTOR IN MPAC.
R0370    L+3       STOVL  NEWVVEC
R0371    L+4       STADR
R0372    L+5       STORE  NEWRVEC            NEWVVEC AND NEWRVEC ARE SYMBOLIC REPRESENTATIONS OF THE USERS LOCATIONS.
R0374    L+6              ...                CONTINUE
R0375
R0376    ABORT EXIT MODES -
R0377    L         CALL   BON
R0378    L+1              TIMETHET
R0379    L+2              COGAFLAG
R0380    L+3              COGABORT       RESTRICTION 1 HAS BEEN VIOLATED.
R0381    L+4       BON                   IF NEITHER FLAG IS SET AND RESTRICTION 2 HAS NOT BEEN VIOLATED, THE SOLUTION IS
R0383                                    GOOD, SO CONTINUE
R0384    L+5              INFINFLG
R0385    L+6              IMPOSSBL       NO SOLUTION EXISTS.
R0386
R0387    OUTPUT -
R0388              * SCALE FACTOR *
R0389    VARIABLE*IN POWERS OF 2*                        DESCRIPTION AND REMARKS
R0390    --------*--------------*                        -----------------------
R0391    T (30D) *    +28       *DP TRANSFER TIME IN CENTISECONDS
R0392    INFINFLG* NONE         *AN INTERPRETIVE SWITCH WHICH IS SET IF THE TRANSFER ANGLE REQUIRES CLOSURE THROUGH
R0394            *              *INFINITY (NO SOLUTION), CLEAR IF A PHYSICAL SOLUTION IS POSSIBLE.
R0396    COGAFLAG* NONE         *AN INTERPRETIVE SWITCH WHICH IS SET IF RESTRICTION 1 HAS BEEN VIOLATED (NO SOLUTION),
R0396            *              *CLEAR IF NOT.

R0399    IN ADDITION, IF VTARGTAG IS NON-ZERO, THE FOLLOWING ARE OUTPUT -
R0400    MPAC -   *  +7 FOR EARTH *DP TERMINAL VELOCITY VECTOR IN METERS/CENTISEC.
R0401    MPAC +5*   +5 FOR MOON *
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R0402   0D - 5D * +29 FOR EARTH+DP TERMINAL POSITION VECTOR IN METERS (PL AT 6D)
R0403   * +27 FOR MOON *

R0404   FOR OTHER OUTPUT WHICH MAY BE OF USE, SEE DEBRIS.
R0405
R0406   DEBRIS -

R0407   PARAMETERS WHICH MAY BE OF USE -

R0408   * SCALE FACTOR *
R0409   VARIABLE*IN POWERS OF 2*   DESCRIPTION AND REMARKS
R0410   --------*-------------*   ----------------------
R0411   R1 (32D)* +29 FOR EARTH+DP MAGNITUDE OF INITIAL POSITION VECTOR, RVEC, IN METERS
R0413   * +27 FOR MOON *
R0414   R1A   * +6   *DP RATIO OF R1 TO SEMIMAJOR AXIS (NEG. FOR HYPERBOLIC TRAJECTORIES)
R0416   P   * +4   *DP RATIO OF SEMILATUS RECTUM TO R1
R0417   COGA   * +5   *DP COTAN OF ANGLE BETWEEN RVEC AND VVEC
R0419   UR1   * +1   *DP UNIT VECTOR OF RVEC
R0420   U2   * +1   *DP UNIT VECTOR OF VVEC
R0421   UN   * +1   *DP UNIT VECTOR OF UR1*U2
R0422

R0423   PARAMETERS OF NO USE -
R0424   SP PARAMETERS - RTNTT, GEOMSGN, RTNPRM, MAGVEC2=R2 (DP), PLUS PUSHLIST LOCATIONS 0-11D, 14D-21D, 24D-39D, 41D
R0426   ADDITIONAL INTERPRETIVE SWITCHES USED - NORMSW, 360SW
R0427

L   CONIC SUBROUTINES

P0428   PROGRAM DESCRIPTION - TIME-RADIUS SUBROUTINE
R0430   MOD NO. -1
R0432   MOD BY KRAUSE
R0434
R0435   FUNCTIONAL DESCRIPTION -

R0436   THIS SUBROUTINE, GIVEN AN INITIAL STATE VECTOR AND A DESIRED RADIUS TO WHICH THE
R0436   STATE IS TO BE UPDATED ALONG A CONIC TRAJECTORY, CALCULATES THE CORRESPONDING TIME-OF-FLIGHT AND, IN ADDITION,
R0440   PROVIDES THE OPTION OF COMPUTING THE NEW UPDATED STATE VECTOR.   THE RESULTING TRAJECTORY MAY BE A SECTION OF A
R0442   CIRCLE, ELLIPSE, PARABOLA, OR HYPERBOLA WITH RESPECT TO THE EARTH OR THE MOON.   THE USE OF THE SUBROUTINE CAN BE
R0444   EXTENDED USING OTHER PRIMARY BODIES BY SIMPLE ADDITIONS TO THE MUTABLE WITHOUT INTRODUCING ANY CODING CHANGES,
R0446   ACCEPTING THE INHERENT SCALE FACTOR CHANGES IN POSITION AND VELOCITY.
R0447   IF THE DESIRED RADIUS IS BEYOND THE RADIUS OF APOCENTER OF THE CONIC OR BELOW THE RADIUS OF PERICENTER,
R0449   APSESW WILL BE SET AND THE SUBROUTINE WILL RETURN THE APOCENTER OR PERICENTER SOLUTION, RESPECTIVELY.
R0451

R0452   THE RESTRICTIONS ARE -
R0453   1. THE ANGLE BETWEEN ANY POSITION VECTOR AND ITS VELOCITY VECTOR MUST BE GREATER THAN 1 DEGREE 47.5 MINUTES
R0455   AND LESS THAN 176 DEGREES 12.5 MINUTES.
R0456   2. THE PARAMETERS IN THE PROBLEM MUST NOT EXCEED THEIR SCALING LIMITS SPECIFIED IN THE GSOP.   IF THE LIMITS
R0458   ARE EXCEEDED, THE RESULTING SOLUTION WILL BE MEANINGLESS.
R04561   3. AN ACCURACY DEGRADATION OCCURS AS THE SENSITIVITIES OF TIME AND UPDATED STATE VECTOR TO CHANGES IN
R04583 RDESIRED INCREASE.   THIS WILL OCCUR NEAR EITHER APSIS OF THE CONIC AND WHEN THE CONIC IS NEARLY CIRCULAR.   IN
R04585 PARTICULAR, IF THE CONIC IS AN EXACT CIRCLE, THE PROBLEM IS UNDEFINED AND THE SUBROUTINE WILL ABORT.
R04567

R0459   THE AGC COMPUTATION TIME IS APPROXIMATELY .363 SECONDS
R0460
R0461   REFERENCES -
R0462   R-479, MISSION PROGRAMMING DEFINITION MEMO NO. 10, LUNAR LANDING MISSION GSOP-SECTION 5.5, SGA MEMO 67-6.
R0464
R0465   INPUT - ERASABLE INITIALIZATION REQUIRED

R0466   * SCALE FACTOR *
R0467   VARIABLE*IN POWERS OF 2*   DESCRIPTION AND REMARKS
R0468   --------*--------------*   -----------------------
R0469   RVEC   * +29 FOR EARTH*OP INITIAL POSITION VECTOR IN METERS
R0470   * +27 FOR MOON *
R0471   VVEC   * +7 FOR EARTH *OP INITIAL VELOCITY VECTOR IN METERS/CENTISECOND
R0472   * +5 FOR MOON *
R0473   RDESIRED* +29 FOR EARTH*OP TERMINAL RADIAL DISTANCE ON CONIC TRAJECTORY FOR WHICH TRANSFER TIME IS TO BE
R0475   * +27 FOR MOON *COMPUTED.
R0476   SGNROOT * NONE   *SP TAG SET TO +.5 OR -.5 ACCORDING TO WHETHER THE RADIAL VELOCITY AT RDESIRED IS TO BE
R0476   *   *POSITIVE OR NEGATIVE, RESPECTIVELY.   THIS TAG REDUCES THE DOUBLE-VALUED PROBLEM TO A

L   CONIC SUBROUTINES

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R0480              *              *SINGLE-VALUED PROBLEM.
R0481    X1 (38D)*NONE            *INDEX REGISTER TO BE SET TO -2D OR -10D ACCORDING TO WHETHER THE EARTH OR MOON,
R0483              *              *RESPECTIVELY, IS THE CENTRAL BODY.
R0484    RVSW    * NONE           *AN INTERPRETIVE SWITCH TO BE SET IF ONLY TIME IS TO BE AN OUTPUT, CLEAR IF THE NEW STATE
R0486              *              *IS TO BE COMPUTED ALSO.
R0487
R0488    SUBROUTINES CALLED -
R0489        PARAM, GEOM, GETX, DELTIME, NEWSTATE
R0490
R0491    CALLING SEQUENCE AND NORMAL EXIT MODES -

R0492        IF ONLY TIME IS DESIRED AS OUTPUT -
R0493    L        SET      CALL         MUST BE IN INTERPRETIVE MODE AND OVFIND MUST BE CLEAR
R0495    L+1               RVSW
R0496    L+2               TIMERAD      RETURN WITH PL AT 0 AND T IN MPAC
R0497    L+3      ...                   CONTINUE
R0498

R0499        IF THE UPDATE STATE VECTOR IS DESIRED AS WELL -
R0500    L        CLEAR    CALL         MUST BE IN INTERPRETIVE MODE AND OVFIND MUST BE CLEAR
R0502    L+1               RVSW
R0503    L+2               TIMERAD      RETURNS WITH PL AT 6.  THE INITIAL POSITION VECTOR IS IN 0D OF THE PUSHLIST AND
R0505                                   THE INITIAL VELOCITY VECTOR IN MPAC.
R0506    L+3      STOVL    NEWVVEC
R0507    L+4      STADR
R0508    L+5      STORE    NEWRVEC                  NEWVVEC AND NEWRVEC ARE SYMBOLIC REPRESENTATIONS OF THE USERS LOCATIONS.
R0510    L+6      ...                               CONTINUE
R0511
R0512    ABORT EXIT MODES -
R0513    L        CALL     BON
R0514    L+1               TIMERAD
R0515    L+2               COGAFLAG
R0516    L+3               COGABORT     RESTRICTION 1 HAS BEEN VIOLATED.
R0517    L+4      BON      BON
R0520    L+5               INFINFLG
R0521    L+6               IMPOSSBL     NO SOLUTION EXISTS.
R05211   L+7               SOLNSW
R05212   L+8               IMPOSSBL     SOLUTION IS UNDEFINED SINCE CONIC IS A CIRCLE.  RESTRICTION 3 HAS BEEN VIOLATED.
R05214   L+9      ...                   IF ALL THREE OF THE FLAGS ARE CLEAR, A SOLUTION EXISTS, SO CONTINUE.
R0522
R0523    OUTPUT -
R0524              * SCALE FACTOR *
```

L   CONIC SUBROUTINES

R0525	VARIABLE*IN POWERS OF 2*	DESCRIPTION AND REMARKS
R0526	--------*--------------*	------------------------
R0527	T (30D) * +28	*DP TRANSFER TIME IN CENTISECONDS
R0526	INFINFLG* NONE	*AN INTERPRETIVE SWITCH WHICH IS SET IF RDESIRED AND SGNRDOT REQUIRE CLOSURE THROUGH
R0530	*	*INFINITY (NO SOLUTION), CLEAR IF A PHYSICAL SOLUTION IS POSSIBLE.
R0532	COGAFLAG* NONE	*AN INTERPRETIVE SWITCH WHICH IS SET IF RESTRICTION 1 HAS BEEN VIOLATED (NO SOLUTION),
R0534	*	*CLEAR IF NOT.
R0535	APSESW * NONE	*AN INTERPRETIVE SWITCH WHICH IS SET IF RDESIRED WAS GREATER THAN RADIUS OF APOCENTER OR
R0537	*	*LESS THAN RADIUS OF PERICENTER. THE APOCENTER OR PERICENTER SOLUTION, RESPECTIVELY,
R0539	*	*WILL THEN BE RETURNED. THE SWITCH IS CLEAR IF RDESIRED WAS BETWEEN PERICENTER AND
R0541	*	*APOCENTER.
R05411	SOLNSW * NONE	*AN INTERPRETIVE SWITCH WHICH IS SET IF THE CONIC IS SO CLOSE TO A CIRCLE THAT THE TERMIN
R05413		*POINT IS AMBIGUOUS, VIOLATING RESTRICTION 3. IF ECCENTRICITY IS GREATER THAN 2-TO-THE-
R05415		*MINUS-18, THE SWITCH IS CLEAR.
R0542		

R0543   IN ADDITION, IF VTARGTAG IS NON-ZERO, THE FOLLOWING ARE OUTPUT -

R0544	MPAC - * +7 FOR EARTH	*DP TERMINAL VELOCITY VECTOR IN METERS/CENTISEC.
R0545	MPAC +5* +5 FOR MOON	*
R0546	0D - 5D * +29 FOR EARTH	*DP TERMINAL POSITION VECTOR IN METERS (PL AT 6D)
R0547	* +27 FOR MOON	*

R0546   FOR OTHER OUTPUT WHICH MAY BE OF USE, SEE DEBRIS.
R0549
R0550   DEBRIS -

R0551   PARAMETERS WHICH MAY BE OF USE -

R0552	* SCALE FACTOR *	
R0553	VARIABLE*IN POWERS OF 2*	DESCRIPTION AND REMARKS
R0554	--------*--------------*	------------------------
R0555	R1 (32D)* +29 FOR EARTH	*DP MAGNITUDE OF INITIAL POSITION VECTOR, RVEC, IN METERS
R0557	* +27 FOR MOON	*
R0556	R1A * +6	*DP RATIO OF R1 TO SEMIMAJOR AXIS (NEG. FOR HYPERBOLIC TRAJECTORIES)
R0560	P * +4	*DP RATIO OF SEMILATUS RECTUM TO R1
R0561	COGA * +5	*DP COTAN OF ANGLE BETWEEN RVEC AND VVEC
R0563	UR1 * +1	*DP UNIT VECTOR OF RVEC
R0564	U2 * +1	*DP UNIT VECTOR OF VVEC
R0565	UN * +1	*DP UNIT VECTOR OF UR1*U2
R0566	CSTH * +1	*DP COSINE OF TRUE ANOMALY DIFFERENCE BETWEEN RVEC AND RDESIRED.
R0568	SNTH * +1	*DP SINE OF TRUE ANOMALY DIFFERENCE.
R0569		

R0570   PARAMETERS OF NO USE -
R0571   SP PARAMETERS - RINTT, GEOMSGN, RTNPRM, MAGVEC2=R2 (DP), PLUS PUSHLIST LOCATIONS 0-11D, 14D-21D, 24D-39D, 41D
R0573   ADDITIONAL INTERPRETIVE SWITCHES USED - NORMSW, 360SW
R0574

L   CONIC SUBROUTINES   USER=S PAGE NO.   14   E0 S3

P0575 PROGRAM DESCRIPTION - APSIDES SUBROUTINE   DATE - 1 SEPTEMBER 1967
R0577 MOD NO. - 0   LOG SECTION - CONIC SUBROUTINES
R0579 MOD BY KRAUSE   ASSEMBLY - COLOSSUS REVISION 88
R0581
R0582 FUNCTIONAL DESCRIPTION -

R0583   THIS SUBROUTINE, GIVEN AN INITIAL STATE VECTOR CALCULATES THE RADIUS OF PERICENTER AND OF APOCENTER AND THE
R0585 ECCENTRICITY OF THE RESULTING CONIC TRAJECTORY, WHICH MAY BE A STRAIGHT LINE,
R0587 CIRCLE, ELLIPSE, PARABOLA, OR HYPERBOLA WITH RESPECT TO THE EARTH OR THE MOON. THE USE OF THE SUBROUTINE CAN BE
R0589 EXTENDED USING OTHER PRIMARY BODIES BY SIMPLE ADDITIONS TO THE MUTABLE WITHOUT INTRODUCING ANY CODING CHANGES,
R0591 ACCEPTING THE INHERENT SCALE FACTOR CHANGES IN POSITION AND VELOCITY.
R0592

R0593 THE RESTRICTIONS ARE -
R0594   1. IF APOCENTER IS BEYOND THE SCALING OF POSITION, THE SCALE FACTOR LIMIT (536,870,910 METERS WITH RESPECT
R0596 TO THE EARTH OR 134,217,727.5 METERS WITH RESPECT TO THE MOON) WILL BE RETURNED.
R0598   2. THE PARAMETERS IN THE PROBLEM MUST NOT EXCEED THEIR SCALING LIMITS SPECIFIED IN THE GSOP. IF THE LIMITS
R0600 ARE EXCEEDED, THE RESULTING SOLUTION WILL BE MEANINGLESS.

R0601   THE AGC COMPUTATION TIME IS APPROXIMATELY .103 SECONDS.
R0602
R0603 REFERENCES -
R0604   MISSION PROGRAMMING DEFINITION MEMO NO. 10, LUNAR LANDING MISSION GSOP-SECTION 5.5
R0606
R0607 INPUT - ERASABLE INITIALIZATION REQUIRED

R0608   * SCALE FACTOR *
R0609 VARIABLE*IN POWERS OF 2*   DESCRIPTION AND REMARKS
R0610 --------*--------------*   ------------------------
R0611 RVEC   * +29 FOR EARTH*DP INITIAL POSITION VECTOR IN METERS
R0612   * +27 FOR MOON *
R0613 VVEC   * +7 FOR EARTH *DP INITIAL VELOCITY VECTOR IN METERS/CENTISECOND
R0614   * +5 FOR MOON *
R0615 X1 (38D)*NONE   *INDEX REGISTER TO BE SET TO -2D OR -10D ACCORDING TO WHETHER THE EARTH OR MOON,
R0617   *   *RESPECTIVELY, IS THE CENTRAL BODY.
R0618
R0619 SUBROUTINES CALLED -
R0620   PARAM, GEOM
R0621
R0622 CALLING SEQUENCE AND NORMAL EXIT MODES -

L   CONIC SUBROUTINES

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R0623          IF ONLY TIME IS DESIRED AS OUTPUT -
R0624    L        CALL              MUST BE IN INTERPRETIVE MODE AND OVFIND MUST BE CLEAR.
R0626    L+1          APSIDES       RETURNS WITH PL AT 0, RADIUS OF APOCENTER IN MPAC AND RADIUS OF PERICENTER IN 0D
R0628.   L+2     STODL  APOAPSE
R0629    L+3          0D
R0630    L+4.    STORE  PERIAPSE              APOAPSE AND PERIAPSE ARE SYMBOLIC REPRESENTATIONS OF THE USERS LOCATIONS
R0632    L+5     ...            CONTINUE
R0633
R0634    OUTPUT -
R0635          * SCALE FACTOR *
R0636    VARIABLE*IN POWERS OF 2*                   DESCRIPTION AND REMARKS
R0637    --------*----------------*                 ---------------------
R0638    MPAC    * +29 FOR EARTH*DP RADIUS OF APOCENTER IN METERS
R0639          * +27 FOR MOON *
R0640    0D-1D   * +29 FOR EARTH*DP RADIUS OF PERICENTER IN METERS
R0641          * +27 FOR MOON *
R0642    ECC     * +3          *DP ECCENTRICITY OF CONIC TRAJECTORY.

R0643    FOR OTHER OUTPUT WHICH MAY BE OF USE, SEE DEBRIS.
R0644
R0645    DEBRIS -

R0646          PARAMETERS WHICH MAY BE OF USE -

R0647          * SCALE FACTOR *
R0648    VARIABLE*IN POWERS OF 2*                   DESCRIPTION AND REMARKS
R0649    --------*----------------*                 ---------------------
R0650    R1 (32D)* +29 FOR EARTH*DP MAGNITUDE OF INITIAL POSITION VECTOR, RVEC, IN METERS
R0652          * +27 FOR MOON *
R0653    R1A   . * +6          *DP RATIO OF R1 TO SEMIMAJOR AXIS (NEG. FOR HYPERBOLIC TRAJECTORIES)
R0655    P       * +4          *DP RATIO OF SEMILATUS RECTUM TO R1
R0656    COGA    * +5          *DP COTAN OF ANGLE BETWEEN RVEC AND VVEC
R0656    UR1     * +1          *DP UNIT VECTOR OF RVEC
R0659    U2      * +1          *DP UNIT VECTOR OF VVEC
R0660    UN      * +1          *DP UNIT VECTOR OF UR1*U2
R0661    MAGVEC2 * +7 FOR EARTH *DP MAGNITUDE OF VVEC
R0662          * +5 FOR MOON  *
R0663

R0664          PARAMETERS OF NO USE -
R0665    SP PARAMETERS - RTNAPSE, GEOMSGN, RTNPRM, PLUS PUSHLIST LOCATIONS 0-5,10D-11D, 14D-21D, 31D-38D.
R0667    ADDITIONAL INTERPRETIVE SWITCHES USED - NORMSW
R0668
0669     REP    1              12,2000              SETLOC CONICS
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0670					12,2000			BANK		
0671	REP	1						COUNT	12/CONIC	
0672	REP	2	LAST	94	E5,1723			EBANK=	UR1	
0678					12,2000	71201 1	KEPLERN	SETPD	DLOAD	
0679					12,2001	00001 0			0	
0680	REP	1			12,2002	11456 0			KEPZERO	
0681	REP	1			12,2003	01344 0		STORE	XMODULO	
0682	REP	1			12,2004	31346 1		STOVL*	TMODULO	
0683	REP	5	LAST	548	12,2005	11631 0			MUTABLE,1	
0684					12,2006	24017 1		STOVL	14D	
0685	REP	3	LAST	503	12,2007	01503 0			RRECT	
0686					12,2010	66258 0		UNIT	SSP	
0687	REP	1			12,2011	00027 1			ITERCTR	
0688					12,2012	00024 1			20D	
0689	REP	2	LAST	94	12,2013	16647 0		STODL	URRECT	
0690					12,2014	00045 0			38D	
0691	REP	2	LAST	861	12,2015	24041 1		STOVL	R1	
0892	REP	4	LAST	1247	12,2016	01503 0			RRECT	
0693					12,2017	78441 1		DOT	SL1R	
0694	REP	2	LAST	63	12,2020	01511 0			VRECT	
0895					12,2021	78405 1		DMP	SL1R	
0896	REP	1			12,2022	00023 0			1/ROOTMU	1/ROOTMU (-17 OR -14)
0697	REP	1			12,2023	24043 0		STOVL	KEPC1	C_1=R.V/ROOTMU (+17 OR +18)
0698	REP	3	LAST	1247	12,2024	01511 0			VRECT	
0899					12,2025	57238 1		VSQ	DMPR	
0700	REP	1			12,2026	00017 1			1/MU	1/MU (-34 OR -28)
0701					12,2027	52405 1		DMP	SL3	
0702	REP	3	LAST	1247	12,2030	00041 1			R1	
0703					12,2031	61425 0		DSU	ROUND	
0704	REP	1			12,2032	11500 1			D1/64	
0705	REP	1			12,2033	00045 0		STORE	KEPC2	C_2=RV.V/MU -1 (+6)
0706					12,2034	74421 0		BDSU	SR1R	
0707	REP	2	LAST	1247	12,2035	11500 1			D1/64	
0708					12,2036	77671 1		DDV		
0709	REP	4	LAST	1247	12,2037	00041 1			R1	
0710	REP	1			12,2040	00011 1		STORE	ALPHA	ALPHA=$(1-C_2)$/R1 (-22 OR -20)
0711					12,2041	71244 0		BPL	DLOAD	MAXIMUM X DEPENDS ON TYPE OF CONIC
0712	REP	1			12,2042	24051 0			1REV	
0713	REP	1			12,2043	11518 0			-50SC	-50SC (+12)
0714					12,2044	40071 0		DDV	BOV	
0715	REP	2	LAST	1247	12,2045	00011 1			ALPHA	
0716	REP	1			12,2046	24055 1			STOREMAX	
0717					12,2047	52166 1		SQRT	GOTO	
0718	REP	2	LAST	1247	12,2050	24055 1			STOREMAX	

L   CONIC SUBROUTINES

0T19				.	12,2051	55366 1	1REV	SQRT	BDDV
0T20	REP	2	LAST	549	12,2052	11520 0			2PISC
0T21					12,2053	77800 1		BOV	
0T22	REP	3	LAST	1247	12,2054	24055 1			STOREMAX
0T23					12,2055	50165 0	STOREMAX	SIGN	BMN
0T24	REP	2	LAST	66	12,2056	02312 0			TAU.
0T25	REP	1		.	12,2057	24272 0			BACKWARD
0T26	REP	1			12,2080	00013 0		STORE	XMAX
0T27					12,2061	65205 0		DMP	PDDL
0T28	REP	2	LAST	1247	12,2062	00023 0		.	1/ROOTMU
0T29	REP	3	LAST	1247	12,2083	00011 1			ALPHA
0T30					12,2084	65301 0		NORM	PDDL
0T31	REP	56	LAST	1231	12,2085	00047 1			X1
0T32					12,2066	56257 1		SL*	DDV
0T33					12,2087	20173 0			0 -6,1
0T34		.			12,2070	50000 1	PERIODCH	BOV	BMN
0T35	REP	1			12,2071	24112 0			MODDONE
0T36	REP	2	LAST	1246	12,2072	24112 0			MODDONE
0T37					12,2073	77806 1		PUSH	BDSU
0T38					12,2074	50021 1		BDSU	BMN
0T39	REP	3	LAST	1248	12,2075	02312 0			TAU.
0T40	REP	3	LAST	1246	12,2076	24112 0			MODDONE
0T41	REP	4	LAST	1246	12,2077	16312 0		STODL	TAU.
0T42	REP	2	LAST	1248	12,2100	00013 0			XMAX
0T43					12,2101	77615 0		DAD	
0T44	REP	2	LAST	1247	12,2102	01344 0			XMODULO
0T45	REP	3	LAST	1246	12,2103	15344 0		STODL	XMODULO
0T46					12,2104	00001 0			0D
0T47					12,2105	77615 0		DAD	
0T48	REP	2	LAST	1247	12,2106	01348 1			TMODULO
0T49	REP	3	LAST	1246	12,2107	15346 1		STODL	TMODULO
0T50					12,2110	77850 1		GOTO	
0T51	REP	1			12,2111	24070 0			PERIODCH
0T52					12,2112	71201 1	MODDONE	SETPD	DLOAD
0T53				. .	12,2113	00001 0			0
0T54	REP	2	LAST	1247	12,2114	11456 0			KEPZERO
0T55	REP	1			12,2115	14015 0		STODL	XMIN
0T56	REP	2	LAST	87	12,2116	02306 0			XKEPNEW
0T57					12,2117	77625 0		DSU	
0T58	REP	4	LAST	1248	12,2120	01344 0			XMODULO
0T59	REP	1			12,2121	00025 0		STORE	X
0T60					12,2122	50054 0		BZE	BMN
0T61	REP	1			12,2123	24265 0			BADX
0T62	REP	2	LAST	1246	12,2124	24265 0			BADX
0T63					12,2125	51025 1		DSU	BPL
0T64	REP	3	LAST	1248	12,2126	00013 0			XMAX
0T65	REP	3	LAST	1248	12,2127	24265 0			BADX

Right-side annotations:

2PISC (+6)

PL AT 2

DXCH WITH 0D.   0D=ALPHA   PL AT 0,2

PL AT 0

0D=PERIOD (+26)

PL AT 0

L   CONIC SUBROUTINES

0766					12,2130	57345 1	DXCOMP	DLOAD	DMPR	
0767	REF	5	LAST	1248	12,2131	02312 0			TAU.	
0768	REF	1			12,2132	11511 1			BEE22	
07685					12,2133	77646 0		ABS		
0769	REF	1			12,2134	15350 0		STODL	EPSILONT	
0770	REF	2	LAST	83	12,2135	01551 1			TC	
0771					12,2136	45254 0		BZE	DSU	
0772	REF	1			12,2137	24141 0			NEWTC	
0773	REF	4	LAST	1248	12,2140	01348 1			TMODULO	
0774	REF	3	LAST	1249	12,2141	15551 1	NEWTC	STODL	TC	
0775	REF	1			12,2142	01553 0			XPREV	
0776					12,2143	45254 0		BZE	DSU	
0777	REF	1			12,2144	24148 1			XDIFF	
0778	REF	5	LAST	1248	12,2145	01344 0			XMODULO	
0779					12,2146	77821 1	XDIFF	BDSU		
0780	REF	2	LAST	1248	12,2147	00025 0			X	
0781	REF	2	LAST	94	12,2150	02843 1		STORE	DELX	
0782					12,2151	63545 0	KEPLOOP	DLOAD	DSQ	X=XKEP
0783	REF	3	LAST	1249	12,2152	00025 0			X	OD=XSQ (+34 OR +32 -N1) PL AT 2
0784					12,2153	41501 1		NORM	PUSH	
0785	REF	59	LAST	1248	12,2154	00047 1			X1.	
0786					12,2155	53805 1		DMP	SRR*	
0787	REF	4	LAST	1248	12,2156	00011 1			ALPHA	
0788					12,2157	21573 0			0 -6,1.	
0789	REF	1			12,2160	34031 1		STCALL	XI	XI=ALPHA XSQ (+8)
0790	REF	1			12,2161	24426 1			DELTIME	
0791					12,2162	44200 0		BOV	BDSU	
0792	REF	1			12,2163	24312 1			TIMEOVFL.	UNLIKELY
0793	REF	6	LAST	1249	12,2164	02312 0			TAU.	
0794	REF	2	LAST	94	12,2165	02845 1		STORE	DELT	DELT=DEL INDEP
0795					12,2166	44246 1		ABS	BDSU	
0796	REF	2	LAST	1249	12,2167	01350 1			EPSILONT	
0797					12,2170	71244 0		BPL	DLOAD	
0798	REF	1			12,2171	24334 0			KEPCONVG	
0799	REF	10	LAST	893	12,2172	00037 0			T.	
0800					12,2173	80225 1		DSU	NORM	
0801	REF	4	LAST	1249	12,2174	01551 1			TC	
0802	REF	60	LAST	1249	12,2175	00047 1			X1.	
0803					12,2176	60325 0	PDDL	NORM		
0804	REF	3	LAST	1249	12,2177	02843 1			DELX	
0805	REF	31	LAST	1228	12,2200	00050 1			X2.	
0806					12,2201	41260 0	XSU,1	DMP		
0807	REF	32	LAST	1249	12,2202	00047 1			X2.	
0808	REF	3	LAST	1249	12,2203	02645 1			DELT	
0809					12,2204	56257 1	SLR*	DDV		
0810					12,2205	21202 1			1,1.	
0811					12,2206	41542 1	SR1	PUSH		OD=TRIAL DELX PL AT 2
0812					12,2207	71244 0		BPL	DLOAD	

L   CONIC SUBROUTINES

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0813  REP   1
0814  REP   4  LAST 1249    12,2210   24231 1                   POSDELX   X
0815  REP   4  LAST 1248    12,2211   00025 0                             X
0816                        12,2212   00013 0         STORE      XMAX            MOVE MAX BOUND IN
0817  REP   2  LAST 1248    12,2213   45221 1         BDSU       DSU
0818                        12,2214   00015 0                    XMIN                                 PL AT 0
0819  REP   1               12,2215   51000 0        (BOV)       BPL
0820  REP   2  LAST 1250    12,2216   24223 1                    NDXCHNGE
0821                        12,2217   24223 1                    NDXCHNGE
0822                        12,2220   52145 0         DLOAD      GOTO
0823  REP   1               12,2221   00001 0                    0D
0824                        12,2222   24243 1                    NEWDELX
0825  REP   3  LAST 1250    12,2223   45345 1    NDXCHNGE DLOAD   DSU
0826  REP   5  LAST 1250    12,2224   00015 0                    XMIN
0827                        12,2225   00025 0                    X
0828  REP   1               12,2226   52075 1         DMPR       GOTO
0829  REP   2  LAST 1250    12,2227   11514 1                    DP9/10          TO FORCE MPAC +2 TO ZERO
0830                        12,2230   24243 1                    NEWDELX
0831  REP   6  LAST 1250    12,2231   77745 1    POSDELX DLOAD
0832  REP   4  LAST 1250    12,2232   00025 0                    X
0833                        12,2233   00015 0         STORE      XMIN            MOVE MIN BOUND IN
0834  REP   5  LAST 1250    12,2234   45221 1         BDSU       DSU
0835                        12,2235   00013 0                    XMAX                                 PL AT 0
0836  REP   1               12,2236   50000 1        (BOV)       BMN
0837  REP   2  LAST 1250    12,2237   24257 1                    PDXCHNGE
0838                        12,2240   24257 1                    PDXCHNGE
0839                        12,2241   77745 1         DLOAD
0840  REP   4  LAST 1249    12,2242   00001 0                    0D
0841                        12,2243   02643 1    NEWDELX STORE    DELX
0842  REP   2  LAST 1249    12,2244   43254 0         BZE        DAD
0843  REP   7  LAST 1250    12,2245   24334 0                    KEPCONVG
0844  REP   8  LAST 1250    12,2246   00025 0                    X
0845  REP  11  LAST 1249    12,2247   14025 0         STODL      X
0846  REP   5  LAST 1249    12,2250   00037 0                    T
0847                        12,2251   01551 1         STORE      TC
0848  REP   1               12,2252   46034 1    BRNCHCTR RTB     BHIZ
0849  REP   3  LAST 1250    12,2253   24651 0                    CHECKCTR
0850                        12,2254   24334 0                    KEPCONVG
0851  REP   1               12,2255   77650 1                    GOTO
0852                        12,2256   24151 1                    KEPLOOP         ITERATE
0853  REP   6  LAST 1250    12,2257   45345 1    PDXCHNGE DLOAD   DSU
0854  REP   9  LAST 1250    12,2260   00013 0                    XMAX
0855                        12,2261   00025 0                    X
0856  REP   2  LAST 1250    12,2262   52075 1         DMPR       GOTO            TO FORCE MPAC +2 TO ZERO
                            12,2263   11514 1                    DP9/10
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L   CONIC SUBROUTINES

0857	REP	3	LAST 1250	12,2284	24243 1			NEWDELX	
0858				12,2265	70545 1	BADX	DLOAD	SR1
0859	REP	7	LAST 1250	12,2286	00013 0			XMAX
0860	REP	10	LAST 1250	12,2287	00025 0		STORE	X
0861				12,2270	77850 1		GOTO	
0862	REP	1		12,2271	24130 0			DXCOMP
0863	REP	5	LAST 1250	12,2272	14015 0	BACKWARD	STODL	XMIN
0864	REP	3	LAST 1248	12,2273	11456 0			KEPZERO
0865	REP	6	LAST 1251	12,2274	14013 0		STODL	XMAX
0866	REP	3	LAST 1248	12,2275	02306 0			XKEPNEW
0867	REP	11	LAST 1251	12,2276	00025 0		STORE	X
0868				12,2277	51054 1		BZE	BPL
0869	REP	1		12,2300	24305 1			BADBKWDX
0870	REP	2	LAST 1251	12,2301	24305 1			BADBKWDX
0871				12,2302	51025 1		DSU	BPL
0872	REP	6	LAST 1251	12,2303	00015 0			XMIN
0873	REP	2	LAST 1251	12,2304	24130 0			DXCOMP
0874				12,2305	70545 1	BADBKWDX	DLOAD	SR1
0875	REP	7	LAST 1251	12,2306	00015 0			XMIN
0876	REP	12	LAST 1251	12,2307	00025 0		STORE	X
0877				12,2310	77650 1		GOTO	
0878	REP	3	LAST 1251	12,2311	24130 0			DXCOMP
0879				12,2312	50145 1	TIMEOVFL	DLOAD	BMN
0880	REP	13	LAST 1251	12,2313	00025 0			X
08805	REP	1		12,2314	24331 0			NEGTOVFL
0881	REP	9	LAST 1251	12,2315	00013 0		STORE	XMAX
0882				12,2316	70545 1	CMNTOVFL	DLOAD	SR1
0883	REP	5	LAST 1250	12,2317	02843 1			DELX
0884	REP	6	LAST 1251	12,2320	02843 1		STORE	DELX
0885				12,2321	44254 1		BZE	BDSU
08855	REP	1		12,2322	02270 0			KEPRIN
0886	REP	14	LAST 1251	12,2323	00025 0			X
0887	REP	15	LAST 1251	12,2324	14025 0		STODL	X
0888	REP	6	LAST 1250	12,2325	01551 1			TC
0889	REP	12	LAST 1250	12,2326	00037 0		STORE	T
0890				12,2327	77850 1		GOTO	
0891	REP	1		12,2330	24252 1			BRNCHCTR
08911	REP	8	LAST 1251	12,2331	00015 0	NEGTOVFL	STORE	XMIN
08912				12,2332	77650 1		GOTO	
08913	REP	1		12,2333	24316 0			CMNTOVFL
0892				12,2334	44545 0	KEPCONVG	DLOAD	SR4R
0893	REP	5	LAST 1247	12,2335	00041 1			R1
0894				12,2336	74225 1		DSU	VXSC
0895	REP	1		12,2337	00035 1			XSQC(XI)

RECIPE EXCEEDED X BOUNDS - USE XMAX/2

X WAS TOO BIG

L   CONIC SUBROUTINES

Seq	REF	Cnt	LAST	Ref	Address	Octal	F	Instr	Operand	Comment
0696	REF	3	LAST	1247	12,2340	02647	0		URRECT	
0697					12,2341	65372	1	VSL1	PDDL	0D=(R1-XSOC(XI))URRECT (+33 OR +31)
0896	REF	16	LAST	1251	12,2342	00025	0		X	
0699					12,2343	60316	0	DSQ	NORM	
0900	REF	61	LAST	1249	12,2344	00047	1		XI	
0901					12,2345	57275	0	DMPR	DMPR	
0902	REF	3	LAST	1246	12,2346	00023	0		1/ROOTMU	
0903	REF	17	LAST	1252	12,2347	00025	0		X	
0904					12,2350	53605	1	DMP	SRR*	
0905	REF	1			12,2351	00033	1		S(XI)	
0906					12,2352	21572	1		0 -7,1	
0907					12,2353	77621	1	BDSU		
0908	REF	13	LAST	1251	12,2354	00037	0		T	
0909					12,2355	74352	0	SL1	VXSC	
0910	REF	4	LAST	1247	12,2356	01511	0		VRECT	
0911					12,2357	53372	1	VSL1	VAD	
0912					12,2360	77712	0	VSL4		PL AT 0
0913	REF	14	LAST	1229	12,2361	01535	0	STORE	RCV	RCV (+29 OR +27)
0914					12,2362	60246	0	ABVAL	NORM	
0915	REF	33	LAST	1249	12,2363	00050	1		X2	
0916	REF	2	LAST	94	12,2364	16655	0	STODL	RCNORM	
0917	REF	2	LAST	1249	12,2365	00031	0		XI	
0918					12,2366	45275	0	DMPR	DSU	
0919	REF	2	LAST	1252	12,2367	00033	1		S(XI)	
0920	REF	1			12,2370	11476	1		$D_1/126$	
0921					12,2371	76405	1	DMP	SL1R	
0922	REF	1			12,2372	00021	1		ROOTMU	
0923					12,2373	53605	1	DMP	SRR*	
0924	REF	16	LAST	1252	12,2374	00025	0		X	
0925					12,2375	56601	0		0 -3,2	
0926					12,2376	74271	0	DDV	VXSC	
0927	REF	3	LAST	1252	12,2377	02655	0		RCNORM	
0926	REF	4	LAST	1252	12,2400	02647	0		URRECT	
0929					12,2401	65372	1	VSL1	PDDL	0D=URRECT(XI S(XI)-1)X ROOTMU/RCV (+15 OR +13) PL AT 6
0930	REF	2	LAST	1251	12,2402	00035	1		XSOC(XI)	
0931					12,2403	56257	1	SRR*	DDV	
0932					12,2404	56602	0		0 -4,2	
0933	REF	4	LAST	1252	12,2405	02655	0		RCNORM	
0934					12,2406	74221	0	BDSU	VXSC	
0935	REF	1			12,2407	11512	1		$D_1/256$	
0936	REF	5	LAST	1252	12,2410	01511	0		VRECT	
0937					12,2411	42455	0	VAD	VSL8	PL AT 0
0936					12,2412	77626	0	STADR		
0939	REF	13	LAST	1229	12,2413	62234	0	STODL	VCV	VCV (+7 OR +5)
0940	REF	14	LAST	1252	12,2414	00037	0		T	
0941					12,2415	77615	0	DAD		
0942	REF	5	LAST	1249	12,2416	01346	1		TMODULO	
0943	REF	7	LAST	1251	12,2417	15551	1	STODL	TC	

L   CONIC SUBROUTINES

0944	REF	19	LAST	1252	12,2420	00025 0		X
0945					12,2421	77615 0	DAD	
0946	REF	6	LAST	1249	12,2422	01344 0		XMODULO
0947	REF	2	LAST	1249	12,2423	01553 0	STORE	XPREV
0948					12,2424	77650 1	GOTO	
0949	REF	2	LAST	1251	12,2425	02270 0		KEPRIN

0950					12,2426	77776 1	DELTIME	EXIT		MPAC=XI (+6), 0D=XSQ (+34 OR +32 -N1)
0951	REF	7	LAST	1160	12,2427	0 7171 1		TC	POLY
0952					12,2430	00010 0		DEC	6
0953					12,2431	02525 1		2DEC	.083333334
0953					12,2432	12526 0			
0954					12,2433	67356 0		2DEC	-.266666684
0954					12,2434	75666 0			
0955					12,2435	15001 1		2DEC	.406349155
0955					12,2436	23771 1			
0956					12,2437	64342 0		2DEC	-.361196675
0956					12,2440	43874 1			
0957					12,2441	06563 1		2DEC	.210153242
0957					12,2442	04645 1			
0958					12,2443	75173 0		2DEC	-.086221951
0958					12,2444	52672 0			
0959					12,2445	00656 1		2DEC	.026266812
0959					12,2446	14331 0			
0960					12,2447	77633 1		2DEC	-.006163316
0960					12,2450	40512 0			
0961					12,2451	00023 0		2DEC	.001177342
0961					12,2452	11210 1			
0962					12,2453	77774 0		2DEC	-.000199055
0962					12,2454	67506 0			
0963	REF	230	LAST	1226	12,2455	0 6006 1		TC	INTPRET
0964	REF	3	LAST	1252	12,2456	14033 1		STODL	S(XI)
0965	REF	3	LAST	1252	12,2457	00031 0			XI
0966					12,2460	77776 1		EXIT	
0967	REF	6	LAST	1254	12,2461	0 7171 1		TC	POLY
0968					12,2462	00010 0		DEC	6
0969					12,2463	01000 0		2DEC	.031250001
0969					12,2464	00000 1			
0970					12,2465	72525 0		2DEC	-.166666719
0970					12,2466	52506 0			
0971					12,2467	13301 1		2DEC	.355555413
0971					12,2470	15337 1			
0972					12,2471	62776 0		2DEC	-.406347410
0972					12,2472	54733 1			
0973					12,2473	11176 1		2DEC	.266962094
0973					12,2474	13267 0			
0974					12,2475	73410 0		2DEC	-.140117694
0974					12,2476	51674 0			
0975					12,2477	01446 0		2DEC	.049247367
0975					12,2500	33641 1			
0976					12,2501	77451 1		2DEC	-.013081923
0976					12,2502	65233 0			
0977					12,2503	00055 1		2DEC	.002606369
0977					12,2504	37266 1			
0978					12,2505	77767 1		2DEC	-.000529414
0978					12,2506	52336 0			
0979	REF	231	LAST	1254	12,2507	0 6006 1		TC	INTPRET

L   CONIC SUBROUTINES

0960					12,2510	53605 1	DMP	SRR*		PL AT 0
0961					12,2511	00001 0		0D		
0962					12,2512	21574 1		0 -5,1		
0963	REP	3	LAST	1252	12,2513	00035 1	STORE	XSQC(XI)	XSQC(XI) (+33 OR +31)	
0964					12,2514	72405 0	DMP	SL1		
0965	REP	2	LAST	1247	12,2515	00043 0		KEPC1		
0966					12,2516	65234 1	RTB	PDDL	XCH WITH PL. 0D=C1 XSQ C(XI) (+49 OR +46	
0967	REP	10	LAST	1223	12,2517	45562 1		TPMODE		PL AT 0,3
0968					12,2520	53605 1	DMP	SRR*		
0969	REP	4	LAST	1254	12,2521	00033 1		S(XI)		
0990					12,2522	21574 1		0 -5,1		
0991					12,2523	72405 0	DMP	SL1		
0992	REP	2	LAST	1247	12,2524	00045 0		KEPC2		
0993					12,2525	65234 1	RTB	PDDL	3D=C2 XSQ S(XI) (+35 OR +33) PL AT 6	
0994	REP	11	LAST	1255	12,2526	45562 1		TPMODE		
0995	REP	6	LAST	1251	12,2527	00041 1		R1		
0996					12,2530	76261 0	SR	TAD		PL AT 3
0997					12,2531	20607 1		6		
0998					12,2532	41301 0	NORM	DMP	TO PRESERVE SIGNIF.	
0999	REP	62	LAST	1252	12,2533	00047 1		X1		
1000	REP	20	LAST	1253	12,2534	00025 0		X		
1001					12,2535	76257 0	SR*	TAD	X(C2 XSQ S(XI) +R1) (+49 OR +46) PL AT 0	
1002					12,2536	20576 1		0 -3,1		
1003					12,2537	57232 0	SL4R	DMPR		
1004	REP	4	LAST	1252	12,2540	00023 0		1/ROOTMU		
1005	REP	15	LAST	1252	12,2541	00037 0	STORE	T		
1006					12,2542	77616 0	RVQ			

1007					12,2543	71214 0	ITERATOR BONCLR	DLOAD	
1008	REF	1			12,2544	00614 1		SLOPESW	
1009	REF	1			12,2545	24613 0		FIRSTIME	
1010	REF	1			12,2546	00037 0		DEP	
1011					12,2547	60225 1	DSU	NORM	
1012	REF	2	LAST	94	12,2550	02764 0		DEPREV	
1013	REF	63	LAST	1255	12,2551	00047 1		X1	
1014					12,2552	60325 0	PDDL	NORM	
1015	REF	1			12,2553	00015 0		DELINDEP	
1016	REF	34	LAST	1252	12,2554	00050 1		X2	
1017					12,2555	41260 0	XSU,1	DMP	
1018	REF	35	LAST	1256	12,2556	00047 1		X2	
1019	REF	3	LAST	94	12,2557	02762 0		DELDEP	
1020					12,2560	56257 1	SLR*	DDV	PL UP 2
1021					12,2561	21202 1		1,1	
1022					12,2562	43142 1	SR1	BOFF	
1023	REF	1			12,2563	04351 1		ORDERSW	
1024	REF	1			12,2564	24567 0		SGNCHECK	
1025					12,2565	75246 0	ABS	SIGN	IN CASE 2ND DERIV. CHANGED SIGN, MUST
1026	REF	4	LAST	1256	12,2566	02762 0		DELDEP	DISREGARD IT TO FIND MIN.
1027					12,2567	51006 0	SGNCHECK PUSH	BPL	TRIAL DELINDEP PL DOWN 2
1028	REF	1			12,2570	24625 0		POSDEL	
1029					12,2571	43145 0	DLOAD	BON	
1030	REF	1			12,2572	03775 1		INDEP	
1031	REF	2	LAST	1256	12,2573	04311 0		ORDERSW	
1032	REF	1			12,2574	24576 0		MINCHECK	
1033	REF	1			12,2575	00017 1	STORE	MAX	IF NOT 2ND ORDER, CAN MOVE MAX BOUND IN.
1034					12,2576	45221 1	MINCHECK BDSU	DSU	
1035	REF	1			12,2577	00011 1		MIN	
1036					12,2600	51000 0	BOV	BPL	
1037	REF	1			12,2601	24605 1		MODNODEL	
1038	REF	2	LAST	1256	12,2602	24605 1		MODNODEL	
1039					12,2603	77650 1	GOTO		
1040	REF	1			12,2604	24637 0		DELOK	
1041					12,2605	45345 1	MODNODEL DLOAD	DSU	TRIAL DELINDEP WOULD EXCEED MIN BOUND
1042	REF	2	LAST	1256	12,2606	00011 1		MIN	
1043	REF	2	LAST	1256	12,2607	03775 1		INDEP	
1044					12,2610	52005 0	DMP	GOTO	
1045	REF	3	LAST	1250	12,2611	11514 1		DP9/10	
1046	REF	1			12,2612	24641 1		NEWDEL	
1047					12,2613	41345 0	FIRSTIME DLOAD	DMP	
1048	REF	3	LAST	1256	12,2614	00011 1		MIN	
1049	REF	1			12,2615	00051 0		TWEEKIT	DLOAD TWEEKIT(40D) SENSITIVE TO CHANGE.
1050					12,2616	41325 0	PDDL	DMP	S2(41D) SHOULDNT CONTAIN HI ORDER ONES

L   CONIC SUBROUTINES

1051	REP	2	LAST 1256	12,2617	00017 1			MAX
1052	REP	2	LAST 1256	12,2620	00051 0			TWEEKIT
1053				12,2621	77625 0		DSU	
1054				12,2622	52165 1		SIGN	GOTO
1055	REP	5	LAST 1256	12,2623	02762 0			DELDEP
1056	REP	2	LAST 1256	12,2624	24567 0			SGNCHECK
1057				12,2625	43145 0	POSDEL	DLOAD	BON
1058	REP	3	LAST 1256	12,2626	03775 1			INDEP
1059	REP	3	LAST 1256	12,2627	04311 0			ORDERSW
1060	REP	1		12,2630	24632 0			MAXCHECK
1061	REP	4	LAST 1256	12,2631	00011 1		STORE	MIN
1062				12,2632	45221 1	MAXCHECK	BDSU	DSU
1063	REP	3	LAST 1257	12,2633	00017 1			MAX
1064				12,2634	50000 1		BOV	BMN
1065	REP	1		12,2635	24643 0			MODPSDEL
1066	REP	2	LAST 1257	12,2636	24643 0			MODPSDEL
1067				12,2637	77745 1	DELOK	DLOAD	
1068				12,2640	00001 0			0D
1069	REP	2	LAST 1256	12,2641	00015 0	NEWDEL	STORE	DELINDEP
1070				12,2642	77616 0		RVQ	
1071				12,2643	45345 1	MODPSDEL	DLOAD	DSU
1072	REP	4	LAST 1257	12,2644	00017 1			MAX
1073	REP	4	LAST 1257	12,2645	03775 1			INDEP
1074				12,2646	52005 0		DMP	GOTO
1075	REP	4	LAST 1256	12,2647	11514 1			DP9/10
1076	REP	2	LAST 1256	12,2650	24641 1			NEWDEL
1077	REP	153	LAST 1200	12,2651	4 4712 0	CHECKCTR	CS	ONE
1078	REP	36	LAST 1183	12,2652	50 120 1		INDEX	PIXLOC
1079	REP	2	LAST 1247	12,2653	6 0028 0		AD	ITERCTR
1080	REP	37	LAST 1257	12,2654	50 120 1		INDEX	PIXLOC
1081	REP	3	LAST 1257	12,2655	54 028 1		TS	ITERCTR
1082	REP	650	LAST 1224	12,2656	54 154 0		TS	MPAC
1083	REP	62	LAST 1169	12,2657	0 6030 1		TC	DANZIG

IF NOT 2ND ORDER, CAN MOVE MIN BOUND IN.

L   CONIC SUBROUTINES

1084					12,2660	44545 0	NEWSTATE DLOAD	SR4R
1085	REP	7	LAST	1255	12,2661	00041 1		R1
1089					12,2662	74225 1	DSU	VXSC
1090	REP	4	LAST	1255	12,2663	00035 1		XSQC(XI)
1091	REP	3	LAST	1247	12,2664	02724 1		UR1
1092					12,2665	65372 1	VSL1	PDDL
1093	REP	21	LAST	1255	12,2666	00025 0		X
1094					12,2667	60316 0	DSQ	NORM
1095	REP	64	LAST	1256	12,2670	00047 1		X1
1096					12,2671	57275 0	DMPR	DMPR
1097	REP	5	LAST	1255	12,2672	00023 1		1/ROOTMU
1098	REP	22	LAST	1258	12,2673	00025 0		X
1099					12,2674	53805 1	DMP	SRR*
1100	REP	5	LAST	1255	12,2675	00033 1		S(XI)
1101					12,2676	21572 1		0 -7,1
1102					12,2677	77821 1	BDSU	
1103	REP	18	LAST	1255	12,2700	00037 0		T
1104					12,2701	74352 0	SL1	VXSC
1105	REP	15	LAST	893	12,2702	02746 0		VVEC
1108					12,2703	53372 1	VSL1	VAD
1107					12,2704	41512 1	VSL4	PUSH
1108					12,2705	77848 0		ABVAL
1109					12,2706	77701 1	LAMENTER NORM	
1110	REP	65	LAST	1258	12,2707	00047 1		X1
1111	REP	1			12,2710	16722 1	STODL	R2
1112	REP	4	LAST	1254	12,2711	00031 0		XI
1113					12,2712	45205 1	DMP	DSU
1114	REP	6	LAST	1258	12,2713	00033 1		S(XI)
1115	REP	2	LAST	1252	12,2714	11478 1		D1/128
1118					12,2715	76405 1	DMP	SL1R
1117	REP	2	LAST	1252	12,2718	00021 1		ROOTMU
1118					12,2717	53605 1	DMP	SLR*
1119	REP	23	LAST	1258	12,2720	00025 0		X
1120					12,2721	21178 1		0 -3,1
1121					12,2722	74271 0	DDV	VXSC
1122	REP	2	LAST	1258	12,2723	02722 1		R2
1123	REP	4	LAST	1258	12,2724	02724 1		UR1
1124					12,2725	65372 1	VSL1	PDDL
1125	REP	5	LAST	1258	12,2726	00035 1		XSQC(XI)
1126					12,2727	56257 1	SLR*	DDV
1127					12,2730	21175 1		0 -4,1
1128	REP	3	LAST	1258	12,2731	02722 1		R2
1129					12,2732	77821 1	BDSU	
1130	REP	2	LAST	1252	12,2733	11512 1		D1/258
1131					12,2734	53361 0	VXSC	VAD
1132	REP	16	LAST	1258	12,2735	02748 0		VVEC
1133					12,2736	43412 1	VSL8	RVO
R1134								

0D=(R1-XSQC(XI))UR1 (+33 OR 31) PL AT 6

PL AT 0

6D=V2VEC PART (+15 OR 13)   PL AT 12

PL AT 8

L   CONIC SUBROUTINES

1135	REP	1		04,2000			SETLOC CONICS1	
1136				04,3472			BANK	
1137	REP	1					COUNT 04/CONIC	
R1138			DO NOT DISTURB THE ORDER OF THESE CDS, OVERLAYS HAVE BEEN MADE.					
1139				04,3472	00000 1	BEE_{17}	DEC	0	KEEP WITH $D_1/8$ 2DEC $1.0B-17$ (0000004000)
1140				04,3473	04000 0	$D_1/8$	2DEC	$1.0\ B-3$
1140				04,3474	00000 1			
1141				04,3475	00200 0	$D_1/128$	2DEC	$1.0\ B-7$
1141				04,3476	00000 1			
1142				04,3477	00400 0	$D_1/64$	2DEC	$1.0\ B-6$
1142				04,3500	00000 1			
1143				04,3501	10000 0	$D_1/4$	2DEC	$1.0\ B-2$
1143				04,3502	00000 1			
1144				04,3503	02000 0	$D_1/16$	2DEC	$1.0\ B-4$
1144				04,3504	00000 1			
1145				04,3505	01000 0	$D_1/32$	2DEC	$1.0\ B-5$
1145				04,3506	00000 1			
1146				04,3507	00020 0	$D_1/1024$	2DEC	$1.0\ B-10$
1146				04,3510	00000 1			
1147				04,3511	00100 0	$D_1/256$	2DEC	$1.0\ B-8$
1147				04,3512	00000 1			
1148				04,3513	34631 1	$DP9/10$	2DEC	$.9$
1148				04,3514	23146 0			
1149	REP	5	LAST 681	04,3455		KEPZERO	EQUALS LO6ZEROS	
1150				04,3515	77467 1	$-50SC$	2DEC	$-50.0\ B-12$
1150				04,3516	77777 0			
1151				04,3517	03110 1	$2PISC$	2DEC	$6.28318530\ B-6$
1151				04,3520	17665 1			
1152	REP	2	LAST 549	04,3504		BEE_{19}	EQUALS $D_1/32$ -1	2DEC 1.0 B-19 (00000 01000)
1153	REP	3	LAST 1258	04,3510		BEE_{22}	EQUALS $D_1/256$ -1	2DEC 1.0 B-22 (00000 00100)
1154				04,3521	00000 1	ONEBIT	2DEC	$1.0\ B-28$
1154				04,3522	00001 0			
1155				04,3523	37767 0	COCUPLIM	2DEC	$.999511597$
1155				04,3524	37737 0			
1156				04,3525	40010 1	COCLOLIM	2DEC	$-.999511597$
1156				04,3526	40040 1			
R1157								

L   CONIC SUBROUTINES

1158	REP	2	LAST	1246	12,2000			SETLOC CONICS		
1159					12,2737			BANK		
1160	REP	2	LAST	1247	TO 1259'	479	479*	COUNT 12/CONIC		
1161					12,2737	40220 0	TIMETHET	STO	SETPD		PL AT 0
1162	REP	1			12,2740	02712 1			RINTT		
1163					12,2741	00001 0			0		
1164					12,2742	63375 0		VLOAD	PDVL		
1165	REP	11	LAST	893	12,2743	02657 1			RVEC	SETUP FOR PARAM CALL	PL AT 6
1166	REP	17	LAST	1258	12,2744	02746 0			VVEC		
1167					12,2745	77624 1			CALL		
1168	REP	2	LAST	861	12,2746	11527 1			PARAM		
1169					12,2747	45000 0		BOV	CALL		PL AT 0
1170	REP	1			12,2750	24767 1			COGAOVFL		
1171	REP	1			12,2751	24772 0			GETX		
1172					12,2752	43145 0	COMMOUT	DLOAD	BON		
1173	REP	5	LAST	1258	12,2753	00031 0			XI		
1174	REP	2	LAST	893	12,2754	04310 1			INFINFLG		
1175	REP	2	LAST	1260	12,2755	02712 1			RINTT		
1176					12,2756	45014 0		CLEAR	CALL		
1177	REP	2	LAST	893	12,2757	04273 0			COGAFLAG		
1178	REP	2	LAST	1249	12,2760	24428 1			DELTIME		
1179					12,2761	45014 0		BON	CALL		
1180	REP	8	LAST	893	12,2762	03706 0			RVSW		
1181	REP	3	LAST	1260	12,2763	02712 1			RINTT		
1182	REP	1			12,2764	24660 1			NEWSTATE		
1183					12,2765	77650 1		GOTO			
1184	REP	4	LAST	1260	12,2766	02712 1			RINTT		
1185					12,2767	77614 1	COGAOVFL	SETGO			
1186	REP	3	LAST	1260	12,2770	04033 0			COGAFLAG		
1187	REP	5	LAST	1260	12,2771	02712 1			RINTT		

L   CONIC SUBROUTINES

Line	REF	Cnt	LAST	Addr	Octal		Label	Opcode	Operand	Comment	PL
11872				04,3527			BANK	4			
11874	REF	2	LAST 1259	04,2000			SETLOC	CONICS1			
11876				04,3527			BANK				
11878	REF	2	LAST 1259 TO 1260'		29 29*		COUNT*	$$/CONIC			
1188				04,3527	43020 1	PARAM	STQ	CLEAR		MPAC=V1VEC, 0D=R1VEC	PL AT 6
1189	REF	2	LAST 94	04,3530	02755 1			RTNPRM			
1190	REF	7	LAST 850	04,3531	03865 1			NORMSW			
11901				04,3532	77614 1	CLEAR					
11902	REF	4	LAST 1260	04,3533	04273 0			COGAFLAG			
1191				04,3534	45131 0	SSP		CALL			
1192	REF	3	LAST 481	04,3535	02875 1			GEOMSGN			
1193				04,3536	27777 0			37777		GAMMA ALWAYS LESS THAN 180DEG	
1194	REF	1		04,3537	11573 0			GEOM		MPAC=SNGA (+1), 0D=CSGA (+1)	PL AT 2
1195				04,3540	14045 0	STODL		36D		36D=SIN GAMMA (+1)	PL AT 0
1196				04,3541	56261 1	SR		DDV			
1197				04,3542	20606 0			5			
1198				04,3543	00045 0			36D			
1199	REF	4	LAST 861	04,3544	33775 1	STOVL*		COGA			
1200	REF	6	LAST 1247	04,3545	11631 0			MUTABLE,1			
1201	REF	2	LAST 1247	04,3546	14017 1	STODL		1/MU			
1202	REF	3	LAST 94	04,3547	02722 1			MAGVEC2			
1203				04,3550	60316 1	DSQ		NORM			
1204	REF	66	LAST 1258	04,3551	00047 1			X1			
1205				04,3552	41275 1	DMPR		DMP			
1206	REF	3	LAST 1261	04,3553	00017 1			1/MU			
1207	REF	8	LAST 1258	04,3554	00041 1			R1			
1206				04,3555	77657 0	SRR*		.			
1209				04,3556	21576 0			0 -3,1			
1210				04,3557	44206 0	PUSH		BDSU		0D=R1 V1SQ/MU (+6)	PL AT 2
1211	REF	3	LAST 1259	04,3560	11508 1			D1/32			
1212	REF	3	LAST 861	04,3561	16744 1	STODL		R1A		R1A (+6)	PL AT 0
1213				04,3562	60205 0	DMP		NORM			
1214				04,3563	00045 0			36D			
1215	REF	67	LAST 1261	04,3564	00047 1			X1			
1216				04,3565	53605 1	DMP		SR*			
1217				04,3566	00045 0			36D			
1218				04,3567	20575 1			0 -4,1			
1219	REF	3	LAST 861	04,3570	02742 1	STORE		P		P (+4)	
1220				04,3571	77650 1	GOTO					
1221	REF	3	LAST 1261	04,3572	02755 1			RTNPRM			

L   CONIC SUBROUTINES   USER=3 PAGE NO. 31   E5 S3

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1225                                                                      From Lambert
1226    REP   2  LAST    94   04,3573  77656 1  GEOM      UNIT    P267        MPAC=V2VEC,  0D=R1VEC           PL AT 6
                              04,3574  16714 1            STODL   U2          U2 (+1)
1227                          04,3575  00045 0                    36D
1228    REP   4  LAST 1261    04,3576  26722 1            STOVL   MAGVEC2                                     PL AT 0
1229                          04,3577  77656 1            UNIT
1230    REP   5  LAST 1258    04,3600  02724 1            STORE   UR1         UR1 (+1)
1231                          04,3601  72441 0            DOT     SL1
1232    REP   3  LAST 1262    04,3602  02714 1            U2                       SAME AS
1233                          04,3603  77725 1            PDDL                     LUMINARY      0D=CSTH (+1)            PL AT 2
1234                          04,3604  00045 0                    36D
1235    REP   9  LAST 1261    04,3605  24041 1            STOVL   R1          R1 (+29 OR +27)
1236    REP   6  LAST 1262    04,3606  02724 1            UR1
1237                          04,3607  76435 1            VXV     VSL1
1238    REP   4  LAST 1262    04,3610  02714 1            U2
1239                          04,3611  75214 1            BON     SIGN
1240    REP   8  LAST 1261    04,3612  03705 0            NORMSW
1241    REP   1              04,3613  11625 0            HAVENORM
1242    REP   4  LAST 1261    04,3614  02675 1            GEOMSGN
1243                          04,3615  40056 0            UNIT    BOV
1244    REP   1              04,3616  11623 0            COLINEAR
1245    REP   4  LAST  480    04,3617  16676 1  UNITNORM  STODL   UN          UN (+1)
1246                          04,3620  00045 0                    36D
1247                          04,3621  43565 0            SIGN    RVQ         MPAC=SNTH (+1), 34D=SNTH.SNTH (+2)
1248    REP   5  LAST 1262    04,3622  02675 1            GEOMSGN
1249                          04,3623  52162 0  COLINEAR  VSR1    GOTO
1250    REP   1              04,3624  11617 1            UNITNORM
1251                          04,3625  75246 0  HAVENORM  ABVAL   SIGN
1252    REP   6  LAST 1262    04,3626  02675 1            GEOMSGN
1253                          04,3627  77616 0            RVQ         MPAC=SNTH (+1), 34D=SNTH.SNTH (+2)
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L   CONIC SUBROUTINES   USER-S PAGE NO. 32   E5 53

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1254                              12,2772                    BANK    12
1255   REP   3   LAST 1260        12,2000                    SETLOC  CONICS
1256                              12,2772                    BANK

12565  REP   3·LAST 1260 TO 1261'     27    506*             COUNT   12/CON1C

1257                              12,2772   66374 1  GETX    AXT,2   SSP          ASSUMES P (+4) IN MPAC
1258                              12,2773   00003 1                  3
1259   REP   26  LAST 1228        12,2774   00052 0                  S2
1260                              12,2775   00001 0                  1
1261                              12,2776   77614 1          CLEAR
1262   REP   1                    12,2777   04276 0                  360SW
1263                              12,3000   65386 1          SQRT    PDDL         0D=SQRT(P)                  PL AT 2
1264   REP   9   LAST  892        12,3001   02734 0                  CSTH
1265                              12,3002   44342 1          SR1     BDSU
1266   REP   2   LAST   32        12,3003   11502 0                  D1/4
1267                              12,3004   54325 1          PDDL    SRR                                      PL AT 4D
1268   REP  11   LAST  893        12,3005   02732 0                  SNTH
1269                              12,3006   21607 0                  6
1270                              12,3007   77671 1          DDV                                              PL AT 2
1271                              12,3010   77600 1          BOV
1272   REP   1                    12,3011   25125 0                  360CHECK
1273                              12,3012   41225 1          DSU     DMP
1274   REP   5   LAST 1261        12,3013   03775 1                  COGA                                     PL AT 0
1275                              12,3014   40132 0          SL2R    BOV
1276   REP   2   LAST 1263        12,3015   25125 0                  360CHECK
1277                              12,3016   63408 0  WLOOP   PUSH    DSQ          0D=W (+5)                   PL AT 2
1278                              12,3017   65351 0          TLOAD   PDDL         2D=WSQ (+10)                PL AT 5
1279   REP 651   LAST 1257        12,3020   00155 0                  MPAC
1280   REP   4   LAST 1261        12,3021   02744 1                  R1A
1281                              12,3022   76202 0          SR4     TAD                                      PL AT 2
1282                              12,3023   75440 0          BMN     SQRT
1283   REP   1                    12,3024   25210 0                  INFINITY
1284                              12,3025   43306 0          ROUND   DAD                                      PL AT 0D
1285                              12,3026   61000 0          BOV     TIX,2
1286   REP   1                    12,3027   25123 0                  RESETX2
1287   REP   1                    12,3030   25016 1                  WLOOP
1288                              12,3031   40065 0          BDDV    BOV
1289   REP   3   LAST 1258        12,3032   11476 1                  D1/128
1290   REP   2   LAST 1263        12,3033   25210 0                  INFINITY
1291                              12,3034   41440 1  POLYCOEF BMN    PUSH         0D=1/W (+2) OR 16/W (+8)    PL AT 2
1292   REP   3   LAST 1263        12,3035   25210 0                  INFINITY
1293                              12,3036   77716 1          DSQ
1294                              12,3037   41301 0          NORM    DMP
1295   REP  68   LAST 1261        12,3040   00047 1                  X1
1296   REP   5   LAST 1263        12,3041   02744 1                  R1A
1297                              12,3042   77457 1          SRR*    EXIT
1298                              12,3043   21567 0                  0 -10D,1
```

L   CONIC SUBROUTINES

1299	REF	9	LAST 1254	12,3044	0 7171 1		TC	POLY	
1300				12,3045	00005 1		DEC	5	
1301				12,3046	20000 0		2DEC	.5	
1301				12,3047	00000 1				
1302				12,3050	72525 0		2DEC	-.166666770	
1302				12,3051	52471 1				
1303				12,3052	03146 1		2DEC	.100000392	
1303				12,3053	15003 0				
1304				12,3054	75556 0		2DEC	-.071401086	
1304				12,3055	45210 0				
1305				12,3056	01615 1		2DEC	.055503292	
1305				12,3057	13553 0				
1306				12,3060	76371 0		2DEC	-.047264098	
1306				12,3061	63777 0				
1307				12,3062	01232 0		2DEC	.040894204	
1307				12,3063	27367 0				
1308	REF	232	LAST 1254	12,3064	0 8006 1		TC	INTPRET	
1309				12,3065	76405 1		DMP	SL_1R	PL AT 0D
1310				12,3066	43006 0		PUSH	BON	
1311	REF	2	LAST 1263	12,3067	04316 1			380SW	
1312	REF	1		12,3070	25175 0			TRUE380X	
1313				12,3071	60316 0	XCOMMON	DSQ	NORM	
1314	REF	69	LAST 1263	12,3072	00047 1			X1	
1315				12,3073	53605 1		DMP	SRR*	
1316	REF	6	LAST 1263	12,3074	02744 1			R_1A	
1317				12,3075	21565 1			0 -12D,1	
1318	REF	6	LAST 1260	12,3076	14031 0		STODL	XI	XI (+6)
1319	REF	10	LAST 1262	12,3077	00041 1			R1	
1320				12,3100	75542 0		SR_1	SQRT	
1321				12,3101	41306 1		ROUND	DMP	
1322				12,3102	77632 0		SL_4R		PL AT 0
1323	REF	24	LAST 1258	12,3103	00025 0		STORE	X	X (+17 OR +18)
1324				12,3104	60316 0		DSQ	NORM	
1325	REF	70	LAST 1264	12,3105	00047 1			X1	
1326				12,3106	41325 0		PDDL	DMP	0D=XSQ (+34 OR +32 -N1) PL AT 2
1327	REF	4	LAST 1261	12,3107	02742 1			P	
1328	REF	11	LAST 1284	12,3110	00041 1			R1	
1329				12,3111	75452 0		SL_3	SQRT	
1330				12,3112	56405 0		DMP	SL_3R	
1331	REF	6	LAST 1263	12,3113	03775 1			COGA	
1332	REF	3	LAST 1255	12,3114	14043 0		STODL	$KEPC_1$	
1333	REF	7	LAST 1264	12,3115	02744 1			R_1A	
1334				12,3116	43021 0		BDSU	CLEAR	
1335	REF	3	LAST 1247	12,3117	11500 1			$D_1/64$	
1336	REF	3	LAST 1260	12,3120	04270 0			INFINFLG	
1337	REF	3	LAST 1255	12,3121	00045 0		STORE	$KEPC_2$	

1338				12,3122	77616 0			RVQ	
1339				12,3123	77774 0	RESETX2	AXT,2		
1340				12,3124	00003 1			3	
1341				12,3125	51001 1	360CHECK	SETPD	BPL	
1342				12,3126	00001 0			0D	
1343	REF	1		12,3127	25132 0			INVRSEQN	
1344				12,3130	77614 1		SET		
1345	REF	3	LAST 1264	12,3131	04076 1			360SW	
1346				12,3132	75545 1	INVRSEQN	DLOAD	SQRT	
1347	REF	5	LAST 1264	12,3133	02742 1			P	
1348				12,3134	41325 0		PDDL	DMP	0D=SQRT(P) (+2) PL AT 2
1349	REF	12	LAST 1263	12,3135	02732 0			SNTH	
1350	REF	7	LAST 1264	12,3136	03775 1			COGA	
1351				12,3137	65352 0		SL1	PDDL	2D=SNTH COGA (+5) PL AT 4
1352	REF	10	LAST 1263	12,3140	02734 0			CSTH	
1353				12,3141	43202 0		SR4	DAD	
1354	REF	4	LAST 1261	12,3142	11508 1			D1/32	
1355				12,3143	41225 1		DSU	DMP	PL AT 2,0
1356				12,3144	55301 0		NORM	BDDV	
1357	REF	71	LAST 1264	12,3145	00047 1			X1	
1358	REF	13	LAST 1265	12,3146	02732 0			SNTH	
1359				12,3147	51457 0		SLR*	ABS	NOTE' NEAR 360 CASE TREATED DIFFERENTLY
1360				12,3150	21174 0			0 -5,1	
1361				12,3151	63406 0		PUSH	DSQ	0D=1/W (-1) PL AT 2
1362				12,3152	14043 0		STODL	34D	
1363	REF	1		12,3153	11504 0			D1/16	
1364				12,3154	63406 0	1/WLOOP	PUSH	DSQ	2D=G (+4) PL AT 4
1365				12,3155	65234 0		RTB	PDDL	PL AT 7
1366	REF	12	LAST 1255	12,3156	45562 1			TPMODE	
1367	REF	8	LAST 1264	12,3157	02744 1			R1A	
1368				12,3160	40405 1		DMP	SR4	
1369				12,3161	00043 1			34D	
1370				12,3162	77771 0		TAD		PL AT 4
1371				12,3163	75440 0		RVN	SQRT	
1372	REF	4	LAST 1263	12,3164	25210 0			INFINITY	
1373				12,3165	77615 0		DAD		PL AT 2
1374				12,3166	60304 0		TIX,2	NORM	
1375	REF	1		12,3167	25154 0			1/WLOOP	
1376	REF	72	LAST 1265	12,3170	00047 1			X1	
1377				12,3171	77665 1		BDDV		PL AT 0
1378				12,3172	52057 1		SLR*	GOTO	
1379				12,3173	21172 0			0 -7,1	
1380	REF	1		12,3174	25034 1			POLYCOEF	

L   CONIC SUBROUTINES

1381					12,3175	50145 1	TRUE360X DLOAD	BMN
1382	REP	9	LAST	1265	12,3176	02744 1		R1A
1383	REP	5	LAST	1265	12,3177	25210 0		INFINITY
1384					12,3200	60386 1	SQRT	NORM
1385	REP	73	LAST	1265	12,3201	00047 1		X1
1386					12,3202	53865 1	BDDV	SL*
1387	REP	3	LAST	1248	12,3203	11520 0		2PISC
1388					12,3204	20176 0		0 -3,1
1389					12,3205	41425 1	DSU	PUSH
1390					12,3206	77650 1	GOTO	
1391	REP	1			12,3207	25071 0		XCOMMON
1392					12,3210	40001 1	INFINITY SETPD	BOV
1393					12,3211	00001 0		0
1394	REP	1			12,3212	25213 0		OVFLCLR
1395					12,3213	43414 1	OVFLCLR SET	RVQ
1396	REP	4	LAST	1264	12,3214	04070 1		INFINFLG

0D=2PI/SQRT(R1A) -X   PL AT 0,2

NO SOLUTION EXISTS SINCE CLOSURE THROUGH
INFINITY IS REQUIRED

L   CONIC SUBROUTINES

Line	REP	Cnt	LAST	Ref	Addr	Octal	Label	Op	Operand	Comment	PL
1397					12,3215	40220 0	LAMBERT	STQ	SETPD		
1398	REP	5	LAST	94	12,3216	02712 1			RTNLAMB		
1399					12,3217	00001 0			0D		
1400					12,3220	76731 0		SSP	VLOAD*		
1401	REP	4	LAST	1257	12,3221	00027 1			ITERCTR		
1402					12,3222	00024 1			20D		
1403	REP	7	LAST	1261	12,3223	11631 0			MUTABLE,1		
1404	REP	4	LAST	1261	12,3224	14017 1		STODL	1/MU		
1405	REP	3	LAST	480	12,3225	02673 1			TDESIRED		
1406					12,3226	77675 0		DMPR			
1407	REP	1			12,3227	11505 1			$B22_{19}$		
1408	REP	1			12,3230	03777 0		STORE	EPSILONL		
1409					12,3231	77214 0		SET	VLOAD		
1410	REP	2	LAST	1258	12,3232	00474 0			SLOPESW		
1411	REP	6	LAST	481	12,3233	02657 1			R1VEC		
1412					12,3234	45115 0		PDVL	CALL	0D=R1VEC (+29 OR +27)	PL AT 6
1413	REP	10	LAST	482	12,3235	02665 0			R2VEC	MPAC=R2VEC (+29 OR +27)	
1414	REP	2	LAST	1261	12,3236	11573 0			GEOM		
1415	REP	14	LAST	1265	12,3237	16732 0		STODL	SNTH	0D=CSTH (+1)	PL AT 2
1416	REP	5	LAST	1262	12,3240	02722 1			MAGVEC2		
1417					12,3241	65301 0		NORM	PDDL		PL AT 4
1418	REP	74	LAST	1266	12,3242	00047 1			X1		
1419	REP	12	LAST	1264	12,3243	00041 1			R1		
1420					12,3244	56342 1		SR1	DDV		PL AT 2
1421					12,3245	65257 1		SL*	PDDL	DXCH WITH 0D, 0D=R1/R2 (+7)	PL AT 0,2
1422					12,3246	20173 0			0 -6,1		
1423					12,3247	77626 0		STADR			
1424	REP	11	LAST	1265	12,3250	75043 1		STORE	CSTH	CSTH (+1)	
1425					12,3251	44342 1		SR1	BDSU		
1426	REP	3	LAST	1263	12,3252	11502 0			D1/4		
1427	REP	2	LAST	94	12,3253	02736 1		STORE	1-CSTH	1-CSTH (+2)	
1428					12,3254	53106 0		ROUND	B22		
1429	REP	1			12,3255	25465 1			360LAMB		
1430					12,3256	65301 0		NORM	PDDL		PL AT 4
1431	REP	75	LAST	1267	12,3257	00047 1			X1		
1432					12,3260	00001 0			0D		
1433					12,3261	56342 1		SR1	DDV		PL AT 2
1434					12,3262	75457 0		SL*	SQRT		
1435					12,3263	20176 0			0 -3,1		
1436					12,3264	54325 1		PDDL	SR	2D=SQRT(2R1/R2(1-CSTH)) (+5)	PL AT 4
1437	REP	15	LAST	1267	12,3265	02732 0			SNTH		
1438					12,3266	20607 1			6		
1439					12,3267	43271 1		DDV	DAD		PL AT 2
1440	REP	3	LAST	1267	12,3270	02736 1			1-CSTH		
14401					12,3271	77626 0		STADR			
14402	REP	1			12,3272	77760 0		STORE	COGAMAX		
1441					12,3273	50000 1		BOV	RVN	IF OVFL, COGAMAX=COGUPLIM	
1442	REP	1			12,3274	25301 1			UPLIM	IF NEG, USE EVEN IF LT COGLOLIM, SINCE	
14421	REP	1			12,3275	25304 1			MAXCOGA	THIS WOULD BE RESET IN LAMBLOOP	

L   CONIC SUBROUTINES

14422				12,3276	50025 0		DSU	BMN
14423	REP	1		12,3277	11524 1			COGUPLIM
14424	REP	2	LAST 1267	12,3300	25304 1			MAXCOGA
14425				12,3301	77745 1	UPLIM	DLOAD	
14426	REP	2	LAST 1268	12,3302	11524 1			COGUPLIM
14427	REP	2	LAST 1267	12,3303	00017 1		STORE	COGAMAX
1443				12,3304	77745 1	MAXCOGA	DLOAD	
1444	REP	12	LAST 1267	12,3305	02734 0			CSTH
1445				12,3306	45261 0		SR	DSU
1446				12,3307	20607 1			6
1447				12,3310	77626 0		STADR	
1448	REP	2	LAST 94	12,3311	61037 1		STODL	CSTH-RHO
1449	REP	7	LAST 1262	12,3312	02675 1			GEOMSGN
1450				12,3313	71240 1		BMN	DLOAD
1451	REP	1		12,3314	25505 0			LOLIM
1452	REP	3	LAST 1268	12,3315	02740 0			CSTH-RHO
1453				12,3316	56352 1		SL1	DDV
1454	REP	16	LAST 1267	12,3317	02732 0			SNTH
1455				12,3320	77600 1		BOV	
1456	REP	2	LAST 1268	12,3321	25505 0			LOLIM
1457	REP	1		12,3322	00011 1	MINCOGA	STORE	COGAMIN
1458				12,3323	66214 0		BON	SSP
1459	REP	4	LAST 679	12,3324	00715 1			GUESSW
1460	REP	1		12,3325	25471 1			NOGUESS
1461	REP	3	LAST 1257	12,3326	00051 0			TWEEKIT
1462				12,3327	00001 0			00001
1463				12,3330	77745 1		DLOAD	
1464	REP	8	LAST 1265	12,3331	03775 1			COGA
1465				12,3332	77605 1	LAMBLOOP	DMP	
1466	REP	17	LAST 1268	12,3333	02732 0			SNTH
1467				12,3334	45342 0		SR1	DSU
1468	REP	4	LAST 1268	12,3335	02740 0			CSTH-RHO
1469				12,3336	65301 0		NORM	PDDL
1470	REP	76	LAST 1267	12,3337	00047 1			X1
1471	REP	4	LAST 1267	12,3340	02736 0			1-CSTH
1472				12,3341	56257 1		SL*	DDV
1473				12,3342	20170 0			0 -9D,1
1474				12,3343	53040 0		BMN	BZE
1475	REP	1		12,3344	25421 1			NEGP
1476	REP	2	LAST 1268	12,3345	25421 1			NEGP
1477	REP	6	LAST 1265	12,3346	16742 1		STODL	P
1478	REP	9	LAST 1268	12,3347	03775 1			COGA
1479				12,3350	43318 1		DSQ	DAD
1480	REP	1		12,3351	11510 0			D1/1024
1481				12,3352	41301 0		NORM	DMP
1482	REP	77	LAST 1268	12,3353	00047 1			X1
1483	REP	7	LAST 1268	12,3354	02742 1			P
1484				12,3355	44257 1		SR*	BDSU

Comments (right column):

IF COGAMAX GT COGUPLIM, COGAMAX=COGUPLIM

OTHERWISE OK, SO GO TO MAXCOGA

COGUPLIM=.999511597 = MAX VALUE OF COGA
    NOT CAUSING OVFL IN R1A CALCULATION

PL AT 0

COGAMIN (+5)

$0D=SNTH\ COGA-(CSTH-RHO)\ (+7+C(X1))\ PL=2$

$1-CSTH\ (+2)$ PL AT 0

$P=(1-CSTH)/(SNTH\ COGA-(CSTH-RHO))\ (+4)$

1485				12,3356	20571 0			0 -8D,1	
1486	REF	5	LAST 1265	12,3357	11506 1			$D_1/32$	
1487	REF	10	LAST 1266	12,3360	16744 1	STODL	R_1A		$R_1A=2-P(_1+COGA\ COGA)\ (+6)$
1488	REF	8	LAST 1266	12,3361	02742 1			P	
1489				12,3362	45000 0	BOV	CALL		
1490	REF	1		12,3363	25424 1			HIENERGY	
1491	REF	2	LAST 1260	12,3364	24772 0			GETX	
1492				12,3365	77745 1	DLOAD			
1493	REF	17	LAST 1256	12,3366	00037 0			T	
1494	REF	1		12,3367	16764 0	STODL	TPREV		
1495	REF	7	LAST 1264	12,3370	00031 0			XI	
1496	.			12,3371	45014 0	BON	CALL		
1497	REF	5	LAST 1266	12,3372	04310 1			INFINFLG	
1498	REF	3	LAST 1266	12,3373	25421 1			NEGP	HAVE EXCEEDED THEORETICAL BOUNDS
1499	REF	3	LAST 1260	12,3374	24426 1			DELTIME	
1500				12,3375	44200 0	BOV	.BDSU		
1501	REF	1		12,3376	25441 1			BIGTIME	
1502	REF	4	LAST 1267	12,3377	02673 1			TDESIRED	
1503	REF	1		12,3400	02762 0	STORE	TERRLAMB		
1504				12,3401	44246 1	ABS	BDSU		
1505	REF	2	LAST 1267	12,3402	03777 0			EPSILONL	
1506				12,3403	47044 1	BPL	RTB		
1507	REF	1		12,3404	25510 1			INITV	
1508	REF	2	LAST 1250	12,3405	24651 0			CHECKCTR	
1509				12,3406	45030 0	BHIZ	CALL		
1510	REF	1		12,3407	25452 0			SUFPCHEK	
1511	REF	1		12,3410	24543 0			ITERATOR	
1512				12,3411	53145 1	DLOAD		B2E	
1513	REF	652	LAST 1263	12,3412	00155 0			MPAC	
1514	REF	2	LAST 1269	12,3413	25452 0			SUFPCHEK	
1515				12,3414	77615 0	DAD			
1516	REF	10	LAST 1266	12,3415	03775 1			COGA	
1517	REF	11	LAST 1269	12,3416	03775 1	STORE	COGA		
1518				12,3417	77650 1	GOTO			
1519	REF	1		12,3420	25332 1			LAMBLOOP	
1520				12,3421	51145 0	NEGP	DLOAD	BPL	IMPOSSIBLE TRAJECTORY DUE TO INACCURATE
1521	REF	1		12,3422	00015 0			DCOGA	BOUND CALCULATION. TRY NEW COGA.
1522	REF	1		12,3423	25444 1			LOENERGY	
1523				12,3424	71201 1	HIENERGY	SETPD	DLOAD	HIGH ENERGY TRAJECTORY RESULTED
1524				12,3425	00001 0			0	
1525	REF	12	LAST 1269	12,3426	03775 1			COGA	IN OVFL OF P OR R1A, OR XI EXCEEDING 50.
1526	REF	2	LAST 1268	12,3427	00011 1	STORE	COGAMIN		THIS IS THE NEW BOUND.
1527				12,3430	70545 1	COMMONLM	DLOAD	SR1	
1528	REF	2	LAST 1269	12,3431	00015 0			DCOGA	
1529	REF	3	LAST 1269	12,3432	00015 0	STORE	DCOGA		USE DCOGA/2 AS DECREMENT

1530					12,3433	44254 1		BZE	BDSU	
15301	REP	3	LAST	1269	12,3434	25452 0			SUFFCHEK	
1531	REP	13	LAST	1269	12,3435	03775 1			COGA	
1532	REP	14	LAST	1270	12,3436	03775 1		STORE	COGA	
1533					12,3437	77650 1		GOTO		RESTART THIS LOOP
1534	REP	2	LAST	1269	12,3440	25332 1			LAMBLOOP	
1535					12,3441	77745 1	BIGTIME	DLOAD		
1536	REP	2	LAST	1269	12,3442	02764 0			TPREV	
1537	REP	18	LAST	1269	12,3443	00037 0		STORE	T	
1538					12,3444	71201 1	LOENERGY	SETPD	DLOAD	LOW ENERGY TRAJECTORY RESULTED
1539					12,3445	00001 0			0	
1540	REP	15	LAST	1270	12,3446	03775 1			COGA	IN OVERFLOW OF TIME.
1541	REP	3	LAST	1268	12,3447	00017 1		STORE	COGAMAX	THIS IS THE NEW BOUND.
1542					12,3450	77650 1		GOTO		
1543	REP	1			12,3451	25430 1			COMMONLM	
1544					12,3452	51545 1	SUFFCHEK	DLOAD	ABS	
1545	REP	2	LAST	1269	12,3453	02762 0			TERRLAMB	
1546					12,3454	41325 0		PDDL	DMP	
1547	REP	5	LAST	1269	12,3455	02673 1			TDESIRED	PL AT 2D
1548	REP	4	LAST	1267	12,3456	11502 0			D1/4	
1549					12,3457	45215 0		DAD	DSU	PL AT 0D
1550	REP	1			12,3460	11522 1			ONEBIT	
1551					12,3461	43044 0		BPL	SETGO	
1552	REP	2	LAST	1269	12,3462	25510 1			INITV	
1553	REP	1			12,3463	02434 0			SOLNSW	
1554	REP	6	LAST	1267	12,3464	02712 1			RTNLAMB	
1555					12,3465	43001 1	360LAMB	SETPD	SETGO	LAMBERT CANNOT HANDLE CSTH=1
1556					12,3466	00001 0			0	
1557	REP	2	LAST	1270	12,3467	02434 0			SOLNSW	
1558	REP	7	LAST	1270	12,3470	02712 1			RTNLAMB	
1559					12,3471	71331 0	NOGUESS	SSP	DLOAD	
1560	REP	4	LAST	1266	12,3472	00051 0			TWEAKIT	
1561					12,3473	10000 0			20000	
1562	REP	3	LAST	1269	12,3474	00011 1			COGAMIN	
1563					12,3475	65342 1		SR1	PDDL	
1564	REP	4	LAST	1270	12,3476	00017 1			COGAMAX	PL AT 2
1565					12,3477	43342 0		SR1	DAD	
1566					12,3500	77626 0		STADR		PL AT 0
1567	REP	16	LAST	1270	12,3501	74002 0		STORE	COGA	
1568	REP	4	LAST	1269	12,3502	00015 0		STORE	DCOGA	

L   CONIC SUBROUTINES

Line	REF		LAST	Addr	Octal	F	Label	Op	Operand	Comment	PL
1569				12,3503	77650	1		GOTO			
1570	REF	3	LAST 1270	12,3504	25332	1			LAMBLOOP		
1574				12,3505	52145	0	LOLIM	DLOAD GOTO			
1575	REF	1		12,3506	11526	0			COGLOLIM	COGLOLIM=-.999511597	
1576	REF	1		12,3507	25322	0			MINCOGA		
1577				12,3510	60345	0	INITV	DLOAD NORM			
1578	REF	13	LAST 1267	12,3511	00041	1			R1		
1579	REF	76	LAST 1268	12,3512	00047	1			X1		
1580				12,3513	70525	1		PDDL	SR1		PL AT 2
1581	REF	9	LAST 1269	12,3514	02742	1			P		
1582				12,3515	77671	1		DDV			PL AT 0
1583				12,3516	75457	0		SL*	SQRT		
1584				·12,3517	20175	0			0 -4,1		
1585				12,3520	72405	0		DMP	SL1		
1586	REF	3	LAST 1258	12,3521	00021	1			ROOTMU		
1587				12,3522	41206	0		PUSH	DMP	0D=VTAN (+7)	PL AT 2
1588	REF	17	LAST 1270	12,3523	03775	1			COGA		
1589				12,3524	74261	1		SL	VXSC		
1590				12,3525	20206	1			5		
1591	REF	7	LAST 1262	12,3526	02724	1			UR1		
1592				12,3527	77725	1		PDDL		XCH WITH 0D	PL AT 0,6
1593				12,3530	76561	1		VXSC	VSL1		
1594	REF	5	LAST 1262	12,3531	02676	1			LN		PL AT 0
1595				12,3532	53235	0		VXV	VAD		
1596	REF	8	LAST 1271	12,3533	02724	1			UR1		
1597				12,3534	43172	1		VSL1	CLEAR		
1598	REF	3	LAST 1270	12,3535	02674	0			SOLNSW		
1599	REF	18	LAST 1260	12,3536	02746	0		STORE	VVEC		
1600				12,3537	53135	0		SLOAD	BZE		
1601	REF	5	LAST 462	12,3540	02704	0			VTARGTAG		
1602	REF	1		12,3541	25544	0			TARGETV		
1603				12,3542	77650	1		GOTO			
1604	REF	8	LAST 1270	12,3543	02712	1			RTNLAMB		
1605				12,3544	45145	0	TARGETV	DLOAD	CALL		
1606	REF	6	LAST 1267	12,3545	02722	1			MAGVEC2		
1607	REF	1		12,3546	24706	0			LAMENTER		
1608	REF	4	LAST 482	12,3547	02705	1		STORE	VTARGET		
1609				12,3550	77650	1		GOTO			
1610	REF	9	LAST 1271	12,3551	02712	1			RTNLAMB		

L   CONIC SUBROUTINES

1611				12,3552	40220 0	TIMERAD	STQ	SETPD		PL AT 0
1612	REP	1		12,3553	02712 1			RINTR		
1613				12,3554	00001 0			0		
1614				12,3555	63375 0		VLOAD	PDVL		PL AT 6
1615	REP	12	LAST 1260	12,3556	02657 1			RVEC		
1616	REP	19	LAST 1271	12,3557	02746 0			VVEC		
1617				12,3560	77624 1		CALL			
1618	REP	3	LAST 1260	12,3561	11527 1			PARAM		
1619				12,3562	71200 0		BOV	DLOAD		PL AT 0
1620	REP	2	LAST 1260	12,3563	24767 1			CONAOVFL		
1621	REP	6	LAST 1269	12,3564	11506 1			$D1/32$		
1622				12,3565	41225 1		DSU	DMP		
1623	REP	11	LAST 1269	12,3566	02744 1			R1A		
1624	REP	10	LAST 1271	12,3567	02742 1			P		
1625				12,3570	41366 1		SQRT	DMP		
1626	REP	18	LAST 1271	12,3571	03775 1			COGA		
1627				12,3572	74212 0		SL4	VXSC		
1628	REP	5	LAST 1262	12,3573	02714 1			U2		
1629				12,3574	45325 1		PDDL	DSU		PL AT 6
1630	REP	4	LAST 1264	12,3575	11500 1			$D1/64$		
1631	REP	12	LAST 1272	12,3576	02744 1			R1A		
1632				12,3577	52361 1		VXSC	VSU		PL AT 0
1633	REP	9	LAST 1271	12,3600	02724 1			UR1		
1634				12,3601	53512 1		VSL4	UNIT		
16345				12,3602	77600 1		BOV			
16346	REP	2	LAST 1267	12,3603	25465 1			360LAMB	NO SOLUTION SINCE CONIC IS A CIRCLE	
1635				12,3604	60325 0		PDDL	NORM	0D=UNIT(ECC) (+3)	PL AT 6
1636	REP	5	LAST 863	12,3605	02760 1			RDESIRED	36D=ECC (+3)	
1637	REP	79	LAST 1271	12,3606	00047 1			X1		
1638				12,3607	41325 0		PDDL	DMP		PL AT 8
1639	REP	14	LAST 1271	12,3610	00041 1			R1		
1640	REP	11	LAST 1272	12,3611	02742 1			P		
1641				12,3612	56257 1		SL*	DDV		PL AT 6
1642				12,3613	20201 0			0,1		
1643				12,3614	56225 1		DSU	DDV		
1644	REP	2	LAST 1265	12,3615	11504 0			$D1/16$		
1645				12,3616	00045 0			36D	36D=ECC (+3)	
1646	REP	1		12,3617	00031 0		STORE	COSF		
1647				12,3620	63400 0		BOV	DSQ		
1648	REP	1		12,3621	25661 1			BADR2		
1649				12,3622	50021 1		BDSU	BVN		
1650	REP	5	LAST 1270	12,3623	11502 0			$D1/4$		
16505	REP	2	LAST 1272	12,3624	25661 1			BADR2		
1651				12,3625	75366 0		SQRT	SIGN		
1652	REP	4	LAST 863	12,3626	02757 0			SGNRDOT		
16525				12,3627	77614 1		CLEAR			
1653	REP	1		12,3630	04272 1			APSESW		
1654				12,3631	76561 1	TERMNVEC	VXSC	VSL1		
1655	REP	6	LAST 1271	12,3632	02676 1			UN		

L   CONIC SUBROUTINES

1656				12,3633	63235 0	VXV	PDVL	VXCH WITH 0D	PL AT 0,6
1657				12,3634	00001 0		0D	
1658				12,3635	53361 0	VXSC	VAD		PL AT 0
1659	REP	2	LAST 1272	12,3636	00031 0		COSP	
1660				12,3637	41572 1	VSL1	(PUSH)	0D=U2	PL AT 6
1661				12,3640	56241 0	DOT	DDV	LIMITS RESULT TO POSMAX OR NEGMAX
1662	REP	10	LAST 1272	12,3641	02724 1		UR1	
16622	REP	1		12,3642	23701 0		DP1/4	
16624				12,3643	40142 1	SR1	BOV	SCALE BACK DOWN TO NORMAL
16625				12,3644	25645 1		+1	CLEAR OVFIND IF SET
1663	REP	13	LAST 1288	12,3645	26734 0	STOVL	CSTH	CSTH (+1)
1664	REP	11	LAST 1273	12,3646	02724 1		UR1	
1665				12,3647	76435 1	VXV	VSL1	
1666				12,3650	72441 0	DOT	SL1	
1667	REP	7	LAST 1272	12,3651	02676 1		UN	
1668	REP	18	LAST 1288	12,3652	16732 0	STODL	SNTH	SNTH (+1)
1669	REP	12	LAST 1272	12,3653	02742 1		P	
1670				12,3654	77624 1	CALL		
1671	REP	3	LAST 1269	12,3655	24772 0		GETX	
1672				12,3656	77614 1	CLRGO		
16725	REP	4	LAST 1271	12,3657	02634 1		SOLNSW	
1673	REP	1		12,3660	24752 1		COMMNOUT	
1674				12,3661	75345 1	BADR2 DLOAD	SIGN	
16741	REP	2	LAST 676	12,3662	11454 1		LODPHALF	
16742	REP	3	LAST 1273	12,3663	00031 0		COSP	
16743	REP	4	LAST 1273	12,3664	14031 0	STODL	COSP	
1675	REP	4	LAST 1251	12,3665	11456 0		KEPZERO	
16755				12,3666	77614 1	SETGO		
1676	REP	2	LAST 1272	12,3667	04032 1		APSESW	
1677	REP	1		12,3670	25631 1		TERMNVEC	
1678				12,3671	40220 0	APSIDES STO	SETPD	PL AT 0
1679	REP	1		12,3672	02712 1		RTNAPSE	
1680				12,3673	00001 0		0D	
1681				12,3674	63375 0	VLOAD	PDVL	PL AT 6
1682	REP	13	LAST 1272	12,3675	02657 1		RVEC	
1683	REP	20	LAST 1272	12,3676	02746 0		VVEC	
1684				12,3677	77624 1	CALL		
1685	REP	4	LAST 1272	12,3700	11527 1		PARAM	
1686				12,3701	77600 1	BOV		PL AT 0
1687	REP	1		12,3702	25703 1		GETECC	
1688				12,3703	42405 0	GETECC DMP	SL4	
1689	REP	13	LAST 1272	12,3704	02744 1		R1A	
1690				12,3705	75421 1	BDSU	SQRT	
1691	REP	5	LAST 1272	12,3706	11500 1		D1/64	
1692	REP	2	LAST 94	12,3707	02754 0	STORE	ECC	
1693				12,3710	65215 1	DAD	PDDL	PL AT 2
1694	REP	1		12,3711	11474 0		D1/8	

L   CONIC SUBROUTINES

1695	REP	15	LAST 1272	12,3712	00041 1			R1		
1696				12,3713	72405 0		DMP	SL1		
1697	REP	13	LAST 1273	12,3714	02742 1			P		
1698				12,3715	77671 1		DDV			PL AT 0
1699				12,3716	60325 0		PDDL	NORM	OD=RP (+29 OR +27)	PL AT 0
1700	REP	14	LAST 1273	12,3717	02744 1			R1A		PL AT 2
1701	REP	80	LAST 1272	12,3720	00047 1			X1		
1702				12,3721	53725 1		PDDL	SL*		
1703	REP	16	LAST 1274	12,3722	00041 1			R1		PL AT 4
1704				12,3723	20174 1			0 -5,1		
1705				12,3724	45271 1		DDV	DSU		
1706				12,3725	50000 1		BOV	BMN		PL AT 2,0
1707	REP	1		12,3726	25732 0			INFINAPO		
1708	REP	2	LAST 1274	12,3727	25732 0			INFINAPO		
1709				12,3730	77650 1		GOTO			
1710	REP	2	LAST 1273	12,3731	02712 1			RTNAPSE		
1711				12,3732	52145 0	INFINAPO DLOAD	GOTO		RETURNS WITH APOAPSIS IN MPAC,PERIAPSIS	
1712	REP	1		12,3733	11467 1			LDPOSMAX		
1713	REP	3	LAST 1274	12,3734	02712 1			RTNAPSE	THAT PL IS AT 0.	

| 1714 | REP | 3 LAST 1261 | 04,2000 | | | SETLOC CONICS1 |
| 1715 | | | 04,3630 | | | BANK |

| 1716 | REP | 3 LAST 1261 TO 1263' | 65 | 94* | | COUNT 04/CONIC |

1717		04,3630	22437 1	MUTABLE	2DEC*	3.986032 $E10$ $B-36*$	MUE
1717		04,3631	16067 1				
1718		04,3632	15625 1		2DEC*	.25087608 $E-10$ $B+34*$	1/MUE
1718		04,3633	21042 1				
1719		04,3634	30276 1		2DEC*	1.99850495 $E5$ $B-18*$	SQRT(MUE)
1719		04,3635	04773 0				
1720		04,3636	25004 1		2DEC*	.50087529 $E-5$ $B+17*$	1/SQRT(MUE)
1720		04,3637	06702 1				
1721		04,3640	16471 1		2DEC	4.902778 $E6$ $B-30$	MUM
1721		04,3641	01352 1				
1722		04,3642	21412 0		2DEC	.203966 $E-8$ $B+26$	1/MUM
1722		04,3643	20500 0				
1723		04,3644	25477 1		2DEC*	2.21422176 $E4$ $B-15*$	SQRT(MUM)
1723		04,3645	03367 0				
1724		04,3646	27533 1		2DEC*	.45182595 $E-4$ $B+14*$	1/SQRT(MUM)
1724		04,3647	07571 0				
1725	REP	2 LAST 495	04,3468		LDPOSMAX EQUALS LODPMAX	DPPOSMAX IN LOW MEMORY.

| R1727 | ERASABLE ASSIGNMENTS |
| R1728 | KEPLER SUBROUTINE |

R1729		INPUT -
R1730	RRECT	ERASE	+5
R1731	VRECT	ERASE	+5
R1732	TAU.	ERASE	+1
R1733	XKEP	ERASE	+1
R1734	TC	ERASE	+1
R1735	XPREV	ERASE	+1
1736			0016	1/MU	EQUALS 14D
1737			0020	ROOTMU	EQUALS 16D
1738			0022	1/ROOTMU EQUALS 18D
R1739		OUTPUT -
R1740	RCV	ERASE	+5
R1741	VCV	ERASE	+5
R1742	RC	ERASE	+1
R1743	XPREV	ERASE	+1

R1744	DEBRIS -
1745			0010	ALPHA	EQUALS 8D
1746			0012	XMAX	EQUALS 10D

1747				0014	XMIN	EQUALS 12D
1748				0024	X	EQUALS 20D
1749				0030	XI	EQUALS 24D
1750				0032	S(XI)	EQUALS 28D
1751				0034	XSQC(XI)	EQUALS 28D
1752				0036	T	EQUALS 30D
1753				0040	R1	EQUALS 32D
1754				0042	KEPC$_1$	EQUALS 34D
1755				0044	KEPC$_2$	EQUALS 36D
R1756	DELX	ERASE	+1			
R1757	DELT	ERASE	+1			
R1758	URRECT	ERASE	+5			
R1759	RCNORM	ERASE	+1			
R1780	XPREV	EQUALS XKEP				
R1761	LAMBERT SUBROUTINE					

R1762	INPUT-			
R1763	R1VEC	ERASE	+5	
R1764	R2VEC	ERASE	+5	
R1765	TDESIRED	ERASE	+1	
R1766	GEOMSGN	ERASE	+0	
R1767	GUESSW			0 IF COGA GUESS AVAILABLE, 1 IF NOT
R1768	COGA	ERASE	+1	INPUT ONLY IF GUESSW IS ZERO.
R1789	NORMSW			0 IF UN TO BE COMPUTED, 1 IF UN INPUT
R1770	UN	ERASE	+5	ONLY USED IF NORMSW IS 1
R1771	VTARGTAG	ERASE	+0	
R1772	TWEPKIT	EQUALS 40D		ONLY USED IF GUESSW IS 0

R1773	OUTPUT -			
R1774	VTARGET	ERASE	+5	AVAILABLE ONLY IF VTARGTAG IS ZERO.
R1775	V1VEC	EQUALS MPAC		

R1776	DEBRIS -		
R1777	RTNLAMB	ERASE	+0
R1778	U2	ERASE	+5
R1779	MAGVEC2	ERASE	+1
R1780	UR1	ERASE	+5
R1781	R1	EQUALS 31D
R1782	UN	ERASE	+5
R1783	SNTH	ERASE	+1
R1784	CSTH	ERASE	+1
R1785	1-CSTH	ERASE	+1
R1786	CSTH-RHO	ERASE	+1

1787				0016	COGAMAX	EQUALS 14D	CLOBBERS 1/MU
1788				0010	COGAMIN	EQUALS 8D	
1789				0014	DCOGA	EQUALS 12D	
R1790	TWEPKIT	EQUALS 40D					
R1791	P	ERASE	+1				

L   CONIC SUBROUTINES   USER=S PAGE NO. 46   E5 S3

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R1792   COGA        ERASE  +1
R1793   R1A         ERASE  +1
R1794   X           EQUALS 20D
R1795   XSQ         EQUALS 22D
R1796   XI          EQUALS 24D
R1797   S(XI)       EQUALS 26D
R1798   XSQC(XI)    EQUALS 28D
R1799   T           EQUALS 30D
R1800   KEPC1       EQUALS 34D
R1801   KEPC2       EQUALS 36D
R1802   SLOPESW
R1803   SOLNSW
R1804   OTHERS -

R1805   RVEC        EQUALS R1VEC
R1808   VVEC        ERASE  +5
R1807   COGAFLAG .
R1808   RVSW
R1809   INFINFLG
R1610   APSESW
R1811   360SW
R1812   RINTT       EQUALS RTNLAMB
R1813   ECC         ERASE  +1
R1814   RINTR       EQUALS RTNLAMB
R1815   RTNAPSE     EQUALS RTNLAMB
R1816   R2          EQUALS MAGVEC2
 1817                              0030        COSF     EQUALS 24D
R1818   RTNPRM      ERASE  +0
R1819   SGNROOT     ERASE  +0
R1820   RDESIRED    ERASE  +1
R1821   ITERATOR SUBROUTINE

R1822   ORDERSW
 1823                              0016        MAX      EQUALS 14D        CLOBBERS 1/MU
 1824                              0010        MIN      EQUALS 8D
R1825   INDEP       ERASE  +1
 1826                              0014        DELINDEP EQUALS 12D
 1827                              0026        ITERCTR  EQUALS 22D
 1828                              0036        DEP      EQUALS 30D
R1829   DELDEP      ERASE  +1
R1830   DEPREV      ERASE  +1
 1831                              0050        TWEEKIT  EQUALS 40D
R1832   MORE KEPLER

R1833   EPSILONT ERASE  +1
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L   CONIC SUBROUTINES

R1834   MORE LAMBERT

R1835   TERRLAMB EQUALS DELDEP
R1836   TPREV   EQUALS DEPREV
R1837   EPSILONL EQUALS EPSILONT +2   DOUBLE PRECISION WORD

L   INTEGRATION INITIALIZATION   USER=S PAGE NO.   1   E0 S3

R0006   1.0 INTRODUCTION
R0007   ----------------
R0008
R0009.   FROM A USERS POINT OF VIEW, ORBITAL INTEGRATION IS ESSENTIALLY THE SAME AS THE 278 INTEGRATION
R0011   PROGRAM. THE SAME ENTRANCES TO THE PROGRAM WILL BE MAINTAINED, THE SAME STALLING ROUTINE WILL BE USED AND
R0013   OUTPUT WILL STILL BE VIA THE PUSHLIST. THE PRIMARY DIFFERENCES TO A USER INVOLVE THE ADDED CAPABILITY OF
R0015   TERMINATING INTEGRATION AT A SPECIFIC FINAL RADIUS AND THE DIFFERENCE IN STATE VECTOR SCALING INSIDE AND OUT-
R0017   SIDE THE LUNAR SPHERE OF INFLUENCE.
R0018
R0019   IN ORDER TO MAKE THE CSM(LEM)PREC AND CSM(LEM)CONIC ENTRANCES SIMILAR TO FLIGHT 278, THE INTEGRATION PROGRAM
R0021   WILL ITSELF SET THE FINAL RADIUS (RFINAL) TO 0 SO THAT REACHING THE DESIRED TIME ONLY WILL TERMINATE
R0023   INTEGRATION. THE DP REGISTER RFINAL MUST BE SET BY USERS OF INTEGRVS AND INTEGRV, AND MUST BE DONE AFTER THE
R0025   CALL TO INTSTALL.
R0026
R0027.   WHEN THE LM IS ON THE LUNAR SURFACE (INDICATED BY LUNAR SURFACE FLAG SET) CALLS TO LEMCONIC, LEMPREC, AND
R0029   INTEGRV WITH VINFLAG = 0 WILL RESULT IN THE USE OF THE PLANETARY INERTIAL ORIENTATION SUBROUTINES TO PROVIDE
R0031   BOTH THE LMS POSITION AND VELOCITY IN THE REFERENCE COORDINATE SYSTEM.
R0032   THE PROGRAM WILL PROVIDE OUTPUT AS IF INTEGRATION WAS USED. THAT IS, THE PUSHLIST WILL BE SET AS NOTED BELOW AND
R0034.   THE PERMANENT STATE VECTOR UPDATED WHEN SPECIFIED BY AN INTEGRV CALL.
R0035
R0036   USERS OF INTEGRVS DESIRING INTEGRATION (INTYPFLG = 0) SHOULD NOTE THAT THE OBLATENESS PERTURBATION COMPUTATION
R0038   IN LUNAR ORBIT IS TIME DEPENDENT. THEREFORE, THE USER SHOULD SUPPLY AN INITIAL STATE VECTOR VALID AT SOME REAL
R0040   TIME AND THE DESIRED TIME (TDEC1) ALSO AT SOME REAL TIME. FOR CONIC ,,INTEGRATION,, THE USER MAY STILL USE ZERO
R0042   AS THE INITIAL TIME AND DELTA TIME AS THE DESIRED TIME.
R0043
R0044·   2.0 GENERAL DESCRIPTION
R0045   ------------------------
R0046
R0047   THE INTEGRATION PROGRAM OPERATES AS A CLOSED INTERPRETIVE SUBROUTINE AND PERFORMS THESE FUNCTIONS---
R0049   1) INTEGRATES (PRECISION OR CONIC) EITHER CSM OR LM STATE VECTOR
R0050   2) INTEGRATES THE W-MATRIX
R0051   3) PERMANENT OR TEMPORARY UPDATE OF THE STATE VECTOR
R0052
R0053   THERE ARE SIX ENTRANCES TO THE INTEGRATION PROGRAM. FOUR OF THESE (CSMPREC, LEMPREC, CSMCONIC, LEMCONIC) SET
R0055   ALL THE FLAGS REQUIRED IN THE INTEGRATION PROGRAM ITSELF TO CAUSE THE PRECISION OR CONIC INTEGRATION (KEPLER) OF
R0057   THE LM OR CSM STATE VECTOR, AS THE NAMES SUGGEST. ONE ENTRANCE (INTEGRVS) PERMITS THE CALLING PROGRAM TO
R0059   PROVIDE A STATE VECTOR TO BE INTEGRATED. THE CALLING PROGRAM MUST SET THE FLAGS INDICATING (1) PRECISION OR
R0061   CONIC INTEGRATION, (2) IN OR OUT OF LUNAR SPHERE, (3) MIDCOURSE OR NOT, AND THE INTEGRATION PROGRAM COMPLETES
R0063   THE FLAG SETTING TO BYPASS W-MATRIX INTEGRATION. THE LAST ENTRANCE (INTEGRV, USED IN GENERAL BY THE
R0065   NAVIGATION PROGRAMS) PERMITS THE CALLER TO SET FIVE FLAGS (NOT MOONFLAG OR MIDFLAG) BUT NOT TO INPUT A STATE
R0067   VECTOR. ANY PROGRAM WHICH CALLS INTEGRVS OR INTEGRV MUST CALL INTSTALL BEFORE IT SETS THE INTEGRATION FLAGS
R0069   AND/OR STATE VECTOR.
R0070
R0071   THREE SETS OF 42 REGISTERS AND 2 FLAGS ARE USED FOR THE STATE VECTORS. TWO SETS, WHICH MAY NOT BE OVERLAYED, ARE
R0073   USED FOR THE PERMANENT STATE VECTORS FOR THE CSM AND LM. THE THIRD SET, WHICH MAY BE OVERLAYED WHEN INTEGRATION
R0075   IS NOT BEING DONE, IS USED IN THE COMPUTATIONS.
R0076
R0077   THE PERMANENT STATE VECTORS WILL BE PERIODICALLY UPDATED SO THAT THE VECTORS WILL NOT BE OLDER THAN 4 TIMESTEPS.
R0079   THE PERMANENT STATE VECTORS WILL ALSO BE UPDATED WHENEVER THE W-MATRIX IS INTEGRATED OR WHEN A CALLER OF INTEGRV
R0081   SETS STATEFLG (THE NAVIGATION PROGRAMS P20, P22.)

L   INTEGRATION INITIALIZATION   USER=S PAGE NO.   2   Eo S3

R0082   APPENDIX B OF THE USERS GUIDE LISTS THE STATE VECTOR QUANTITIES.
R0083
R0084   2.1 RESTARTS
R0085
R0086   PHASE CHANGES WILL BE MADE IN THE INTEGRATION PROGRAM ONLY FOR THE INTEGRV ENTRANCE (I.E., WHEN THE W-MATRIX IS
R0088   INTEGRATED OR PERMANENT STATE VECTOR IS UPDATED.) THE GROUP NUMBER USED WILL BE THAT FOR THE P20-25 PROGRAMS
R0090   (I.E., GROUP2) SINCE THE INTEGRV ENTRANCE WILL ONLY BE USED BY THESE PROGRAMS. IF A RESTART OCCURS DURING AN
R0092   INTEGRATION OF THE STATE VECTOR ONLY, THE RECOVERY WILL BE TO THE LAST PHASE IN THE CALLING PROGRAM. CALLING
R0094   PROGRAMS WHICH USE THE INTEGRV OR INTEGRVS ENTRANCE OF INTEGRATION SHOULD ENSURE THAT IF PHASE CHANGING IS DONE
R0096   THAT IT IS PRIOR TO SETTING THE INTEGRATION INPUTS IN THE PUSHLIST.
R0097   THIS IS BECAUSE THE PUSHLIST IS LOST DURING A RESTART.
R0098
R0099   2.2 SCALING
R0100
R0101   THE INTEGRATION ROUTINE WILL MAINTAIN THE PERMANENT MEMORY STATE VECTORS IN THE SCALING AND UNITS DEFINED IN
R0103   APPENDIX B OF THE USERS GUIDE. THE SCALING OF THE OUTPUT POSITION VECTOR DEPENDS ON THE ORIGIN OF THE COORDINATE
R0105   SYSTEM AT THE DESIRED INTEGRATION TIME. THE COORDINATE SYSTEM TRANSFORMATION WILL BE DONE AUTOMATICALLY ON
R0107   MULTIPLE TIMESTEP ENCKE INTEGRATION ONLY. THUS IT IS POSSIBLE TO HAVE OUTPUT FROM SUCCESSIVE INTEGRATIONS IN
R0109   DIFFERENT SCALING.
R0110   HOWEVER, RATT, VATT WILL ALWAYS BE SCALED THE SAME.
R0111
R0112   3.0 INPUT/OUTPUT
R0113   ----------------
R0114
R0115   PROGRAM INPUTS ARE THE FLAGS DESCRIBED IN APPENDIX A AND THE PERMANENT STATE VECTOR QUANTITIES DESCRIBED IN AP-
R0117   PENDIX B OF THE USERS GUIDE, PLUS THE DESIRED TIME TO INTEGRATE TO IN $TDEC_1$ (A PUSH LIST LOCATION).
R0119   FOR INTEGRVS, THE RCV,VCV, TET OF THE TEMPORARY STATE VECTOR MUST BE SET, PLUS MOONFLAG AND MIDFLAG
R0121
R0122   FOR SIMULATION THE FOLLOWING QUANTITIES MUST BE PRESET ---
R0123

			EARTH	MOON
R0126 RRECTCSM(LEM)	- RECTIFIED POSITION VECTOR	METERS	2^{29}	2^{27}
R0129 VRECTCSM(LEM)	- RECTIFIED VELOCITY VECTOR	M/CSEC	2^{7}	2^{5}
R0132 TETCSM(LEM)	- TIME STATE VECTOR IS VALID	CSEC	2^{28}	2^{28}
R0133	CUSTOMARILY 0, BUT NOTE LUNAR			
R0134	ORBIT DEPENDENCE ON REAL TIME.			
R0137 DELTAVCSM(LEM)	- POSITION DEVIATION	METERS	2^{22}	2^{18}
R0138	0 IF TCCSM(LEM) = 0			
R0141 NUVCSM(LEM)	- VELOCITY DEVIATION	M/CSEC	2^{3}	2^{-1}
R0142	0 IF TCCSM(LEM) = 0			

R0124
R0125
R0127
R0128
R0130
R0131
R0135
R0136
R0139
R0140
R0143

L   INTEGRATION INITIALIZATION

				EARTH	MOON
R0144					
R0145	RCVCSM(LEM)	– CONIC POSITION	METERS	2^{29}	2^{27}
R0146		EQUALS RRECTCSM(LEM) IF			
R0147		TCCSM(LEM) = 0			
R0148					
R0149				2^7	2^5
R0150	VCVCSM(LEM)	– CONIC VELOCITY	M/CSEC		
R0151		EQUALS VRECTCSM(LEM) IF			
R0152		TCCSM(LEM) = 0			
R0153					
R0154				2^{28}	2^{28}
R0155	TCCSM(LEM)	– TIME SINCE RECTIFICATION	CSECS		
R0156		CUSTOMARILY 0			
R0157					
R0158			$M^{1/2}$	2^{17}	2^{16}
R0159	XKEPCSM(LEM)	– ROOT OF KEPLERS EQUATION			
R0160		0 IF TCCSM(LEM) = 0			
R0161					
R0162	CMOONFLG	– PERMANENT FLAGS CORRESPONDING		0	0
R0163	CMIDFLAG	TO MOONFLAG AND MIDFLAG		0,1	0,1
R0164	LMOONFLG	C = CSM, L = LM		0	0
R0165	LMIDFLG			0,1	0,1
R0166					
R0167	SURFFLAG	– LUNAR SURFACE FLAG		0,1	0,1
R0168					

R0169 IN ADDITION, IF (L)CMIDFLAG IS SET, THE INITIAL INPUT VALUES FOR LUNAR
R0170 SOLAR EPHEMERIDES SUBROUTINE AND PLANETARY INERTIAL ORIENTATION SUB-
R0171 ROUTINE MUST BE PRESET.

R0172
R0173 OUTPUT
R0174 AFTER EVERY CALL TO INTEGRATION

				EARTH	MOON
R0175					
R0176				29	29
R0177	0D	RATT	POSITION	METERS	2	2
R0178					7	7
R0179	6D	VATT	VELOCITY	M/CSEC	2	2
R0180					28	28
R0181	12D	TAT	TIME		2	2
R0182					29	27
R0183	14D	RATT1	POSITION	METERS	2	2
R0184					7	5
R0185	20D	VATT1	VELOCITY	M/CSEC	2	2
R0186					38	30
R0187	26D	MU(P)	MU	M^3/CS^2	2	2
R0188						
R0189	X1		MUTABLE ENTRY		-2	-10D
R0190						
R0191	X2		COORDINT			
R0192	X2		COORDINATE SYSTEM ORIGEN		0	2
R0193			(THIS, NOT MOONFLAG, SHOULD BE			

```
R0194                     USED TO DETERMINE ORIGIN.)
R0195
R0196   IN ADDITION TO THE ABOVE, THE PERMANENT STATE VECTOR IS UPDATED WHENEVER
R0197   STATEFLG WAS SET AND WHENEVER A W-MATRIX IS TO BE INTEGRATED. THE PUSH
R0198   COUNTER IS SET TO 0 AND OVERFLOW IS CLEARED BEFORE RETURNING TO THE
R0199   CALLING PROGRAM.
R0200
R0201   4.0 CALLING SEQUENCES AND SAMPLE CODE
R0202   --------------------------------------
R0203
R0204       A) PRECISION ORBITAL INTEGRATION. CSMPREC,LEMPREC ENTRANCES
R0205            L-X    STORE TIME TO 95T5791T5 T  95 PUS L9ST (T4531)
R0206            L      CALL
R0207            L+1         CSMPREC (OR LEMPREC)
R0208            L+2    RETURN
R0209         INPUT
R0210            TDEC1 (PD 32D) TIME TO INTEGRATE TO...CENTISECONDS SCALED 2^28
R0211         OUTPUT
R0212            THE DATA LISTED IN SECTION 3.0 PLUS
R0213            RCVV   POSITION VECTOR OF VEHICLE WITH RESPECT TO SECONDARY
R0214            BODY... METERS B-29 ONLY IF MIDFLAG = DIMOFLAG = 1
R0215       B) CONIC INTEGRATION. CSMCONIC, LEMCONIC ENTRANCES
R0216            L-X    STORE TIME IN PUSH LIST (TDEC1)
R0217            L      CALL
R0218            L+1         CSMCONIC (OR LEMCONIC)
R0219         INPUT/OUTPUT
R0220            SAME AS PRECISION INTEGRATION, EXCEPT RCVV NOT SET
R0221       C) INTEGRATE GIVEN STATE VECTOR. INTEGRVS ENTRANCE
R0222                    CALL
R0223                         INTSTALL
R0224                    VLOAD
R0225                         POSITION VECTOR
R0226                    STOVL  RCV
R0227                         VELOCITY VECTOR
R0228                    STODL  VCV
R0229                         TIME STATE VECTOR VALID
R0230                    STODL  TET
R0231                         FINAL RADIUS
R0232                    STORE  RFINAL
R0233                    SET(CLEAR)   SET(CLEAR)
R0234                         INTYPFLAG
R0235                         MOONFLAG
R0236                    SET(CLEAR)   DLOAD
R0237                         DESIRED TIME
R0238                    STCALL   TDEC1
R0239                         INTEGRVS
R0240         INPUT
R0241            RCV    POSITION VECTOR              METERS
R0242            VCV    VELOCITY VECTOR              M/CSEC
R0243            TET    TIME OF STATE VECTOR(MAY = 0)  CSEC B-28
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L   INTEGRATION INITIALIZATION   USER=S PAGE NO.   5   E0 S3

R0244				TDEC$_1$ TIME TO INTEGRATE TO	CSEC B-28 (PD 32D)

R0244   TDEC$_1$ TIME TO INTEGRATE TO   CSEC B-28 (PD 32D)
R0245   (MAY BE INCREMENT IF TET=0)
R0246   OUTPUT
R0247   SAME AS FOR PRECISION OR CONIC INTEGRATION,
R0248   DEPENDING ON INTYPFLG.
R0249   D) INTEGRATE STATE VECTOR. INTGRV ENTRANCE
R0250   L-X   STORE TIME IN PUSH LIST (TDEC$_1$)(MAY BE DONE AFTER CALL TO INTSTALL)
R0252   L-8   CALL
R0253   L-7
R0254   L-6   SET(CLEAR) SET(CLEAR)
R0255   L-5   VINTFLAG   1=CSM, 0=LM
R0256   L-4   INTYPFLAG 1=CONIC, 0=PRECISION
R0257   L-3   SET(CLEAR) SET(CLEAR)
R0258   L-2   DIMOFLAG   1=W-MATRIX, 0=NO W-MATRIX
R0259   L-1   D6OR9FLG   1=9X9, 0=6X6
R0260   L   SET   DLOAD
R0261   L+1   STATEFLG   DESIRE PERMANENT UPDATE
R0262   L+2   FINAL RAD. OF STATE VECTOR
R0263   L+3   STCALL   RFINAL
R0264   L+4   INTEGRV
R0265   L   CALL   NORMAL USE-- WILL UPDATE STATE
R0266   L+1   INTEGRV VECTOR IF DIMOFLAG=1.(STATEFLG IS
R0267   L+2   RETURN   ALWAYS RESET IN INTEGRATION AFTER
R0268   IT IS USED.)
R0269   INPUT
R0270   TDEC$_1$ (PD 32D) TIME TO INTEGRATE TO   CSEC B-28
R0271   OUTPUT
R0272   SAME AS FOR PRECISION OR CONIC INTEGRATION
R0273   THE PROGRAM WILL SET MOONFLAG, MIDFLAG DEPENDING ON
R0274   THE PERMANENT STATE VECTOR REPRESENTATION.

02741					11,2310			BANK	11
02742	REF	2	LAST	203	13,2000			SETLOC	INTINIT
02743					13,2561			BANK	
02744	REF	5	LAST	207	E3,1554			EBANK=	RRECTCSM
02745	REF	2	LAST	203 TO	206'	30	30*	COUNT	13/INTIN
0275	REF	92	LAST	1226	13,2561	0 5301 0	STATEINT	TC	PHASCHNG
0276					13,2562	00052 0		OCT	00052
0277	REF	7	LAST	261	13,2563	3 4754 0		CAF	PRIO5
0278	REF	30	LAST	779	13,2564	0 5042 1		TC	FINDVAC
0279	REF	6	LAST	1283	E3,1554			EBANK=	RRECTCSM
0280	REF	2	LAST	207	13,2565	02570 1		2CADR	STATINT1
0280					13,2566	26063 0			
0281	REF	64	LAST	1205	13,2567	0 5213 1		TC	TASKOVER
0282	REF	233	LAST	1264	13,2570	0 6006 1	STATINT1	TC	INTPRET
0283					13,2571	47014 1		BON	RTB
02831	REF	2	LAST	261	13,2572	04712 1			QUITFLAG
02832	REF	1			13,2573	26630 0			NOINT
0284	REF	26	LAST	889	13,2574	45505 0			LOADTIME

NO STATEINT IF V96 (at row 02832)

L   INTEGRATION INITIALIZATION

0266	REP	48	LAST	869	13,2575	00041 1		STORE	TDEC1
0323					13,2576	77624 1		CALL	
0324	REP	22	LAST	1226	13,2577	27371 1			INTSTALL
0325					13,2600	45014 0		SET	CALL
03251	REP	2	LAST	204	13,2601	01076 1			NODOFLAG
0326	REP	2	LAST	204	13,2602	26621 0			SETIFLGS
0327					13,2603	77650 1		GOTO	
0326	REP	1			13,2604	26000 0			STATEUP
0356					13,2605	00003 1	600SECS	2DEC	60000
0356					13,2606	25140 0			
0404					13,2607	77414 0	ENDINT	CLEAR	EXIT
0405	REP	3	LAST	601	13,2610	01672 1			STATEFLG
0406	REP	93	LAST	1283	13,2611	0 5301 0		TC	PHASCHNG
0409					13,2612	20032 1		OCT	20032
0411					13,2613	0 0006 1		EXTEND	
0412	REP	2	LAST	207	13,2614	3 2606 0		DCA	600SECS
0413	REP	3	LAST	642	13,2615	0 5231 1		TC	LONGCALL
0414	REP	6	LAST	260	E3,1554			EBANK=	RRECTHIS
0415	REP	3	LAST	207	13,2616	02561 1		2CADR	STATEINT
0415					13,2617	26063 0			
0416	REP	108	LAST	1009	13,2620	0 5112 0		TC	ENDOFJOB
0426					13,2621	43014 0	SETIFLGS	SET	CLEAR
0427	REP	4	LAST	1284	13,2622	01472 1			STATEFLG
0426	REP	13	LAST	666	13,2623	01673 1			INTYPFLG
0429					13,2624	43014 0		CLEAR	CLEAR
0430	REP	11	LAST	614	13,2625	01676 1			DIM0FLAG
04301	REP	5	LAST	601	13,2626	01675 1			D6OR9FLG
04302					13,2627	77616 0		RVQ	
04303					13,2630	77776 1	NOINT	EXIT	
04304	REP	94	LAST	1284	13,2631	0 5301 0		TC	PHASCHNG
04305					13,2632	00002 0		OCT	2
04306	REP	54	LAST	1037	13,2633	0 5447 0		TC	DOWNFLAG
04307	REP	3	LAST	1263	13,2634	00221 0		ADRES	QUITFLAG
04306	REP	109	LAST	1284	13,2635	0 5112 0		TC	ENDOFJOB

R0431   ATOPCSM TRANSFERS RRECT TO RRECT +41 TO RRECTCSM TO RRECTCSM +41

R0432   CALLING SEQUENCE
R0433   L   CALL
R0434   L+1   ATOPCSM

R0435   NORMAL EXIT AT L+2

0436					13,2636	47020 0	ATOPCSM	STO	RTB
0437	REP	27	LAST	1263	13,2637	00051 0			S2
0436	REP	3	LAST	1230	13,2640	26651 1			MOVEACSM
0439					13,2641	45014 0		SET	CALL
0440	REP	21	LAST	621	13,2642	04063 0			CMOONFLG

L   INTEGRATION INITIALIZATION

```
0441    REP   3   LAST 1230     13,2643    20237 0                    SVDWN1
0442    .                       13,2644    43014 0          BON       CLRGO
0443    REP   12  LAST  869     13,2645    00303 1                    MOONFLAG
0444    REP   28  LAST 1264     13,2646    00051 0                    S2
0445    REP   22  LAST 1284     13,2647    04223 0                    CMOONFLG
0446    REP   29  LAST 1285     13,2650    00051 0                    S2
0447    REP   1                 13,2651    0 3015 0   MOVEACSM TC      SETBANK
0448    REP   2   LAST   63     13,2652    55=500 1            TS      DIFEQCNT     INITIALIZE INDEX
0449    REP   3   LAST 1285     13,2653    51=500 0            INDEX   DIFEQCNT
0450    REP   5   LAST 1247     13,2654    3 1502 1            CA      RRECT
0451    REP   4   LAST 1285     13,2655    51=500 0            INDEX   DIFEQCNT
0452    REP   7   LAST 1263     13,2656    55=554 0            TS      RRECTCSM
0453    REP   5   LAST 1285     13,2657    11=500 1            CCS     DIFEQCNT     IS TRANSFER COMPLETE
0454    REP   4   LAST 1284     13,2660    1 2652 0            TCF     MOVEACSM +1  NO-LOOP
0455    REP   63  LAST 1257     13,2661    0 6030 1            TC      DANZIG       COMPLETE- RETURN
R0456   PTOACSM TRANSFERS RRECTCSM TO RRECTCSM +41 TO RRECT TO RRECT +41

R0457 . CALLING SEQUENCE
R0458      L    CALL
R0459                PTOACSM

R0460 . NORMAL EXIT AT L+2
0461                            13,2662    43034 1   PTOACSM  RTB     BON
0462    REP   2   LAST 1230     13,2663    26700 1                    MOVEPCSM
0463    REP   23  LAST 1285     13,2664    04303 0                    CMOONFLG
0464    REP   1                 13,2665    26673 1                    SETMOON
0465                            13,2666    66214 0   CLRMOON  CLEAR   SSP
0466    REP   13  LAST 1285     13,2667    00263 0                    MOONFLAG
0467    REP   4   LAST 1229     13,2670    02151 0                    PBODY
0468                            13,2671    00000 1                    0
0469                            13,2672    77616 0                    RVQ
0470                            13,2673    66214 0   SETMOON  SET     SSP
0471    REP   14  LAST 1285     13,2674    00063 1                    MOONFLAG
0472    REP   5   LAST 1285     13,2675    02151 0                    PBODY
0473                            13,2676    00002 0                    2
0474                            13,2677    77616 0                    RVQ
0475    REP   2   LAST 1285     13,2700    0 3015 0   MOVEPCSM TC     SETBANK
0476    REP   6   LAST 1285     13,2701    55=500 1            TS      DIFEQCNT
0477    REP   7   LAST 1285     13,2702    51=500 0            INDEX   DIFEQCNT
0478    REP   8   LAST 1285     13,2703    3 1554 1            CA      RRECTCSM
0479    REP   6   LAST 1285     13,2704    51=500 0            INDEX   DIFEQCNT
0480    REP   6   LAST 1285     13,2705    55=502 0            TS      RRECT
0481    REP   9   LAST 1285     13,2706    11=500 1            CCS     DIFEQCNT
0482    REP   3   LAST 1285     13,2707    1 2701 0            TCF     MOVEPCSM +1
0483    REP   64  LAST 1285     13,2710    0 6030 1            TC      DANZIG
R0484   ATOPLEM  TRANSFERS RRECT TO RRECT +41 TO RRECTLEM TO RRECTLEM +41
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L   INTEGRATION INITIALIZATION   USER=S PAGE NO.   6   E3 S3

0485					13,2711	47020 0	ATOPLEM	STQ	RTB
0486	REP	30	LAST	1285	13,2712	00051 0			S2
0487	REP	2	LAST	1229	13,2713	26724 1			MOVEALEM
0488					13,2714	45014 0		SET	CALL
0489	REP	3	LAST	576	13,2715	04064 1			LMOONFLG
0490	REP	3	LAST	1229	13,2716	20283 1			SVDWN2
0491					13,2717	43014 0		BON	CLRGO
0492	REP	15	LAST	1285	13,2720	00303 1			MOONFLAG
0493	REP	31	LAST	1266	13,2721	00051 0			S2
0494	REP	4	LAST	1266	13,2722	04224 1			LMOONFLG
0495	REP	32	LAST	1266	13,2723	00051 0			S2
0496	REP	3	LAST	1265	13,2724	0 3015 0	MOVEALEM	TC	SETBANK
0497	REP	10	LAST	1285	13,2725	55∝500 1		TS	DIFEQCNT
0498	REP	11	LAST	1286	13,2726	51∝500 0		INDEX	DIFEQCNT
0499	REP	7	LAST	1285	13,2727	3 1502 1		CA	RRECT
0500	REP	12	LAST	1266	13,2730	51∝500 0		INDEX	DIFEQCNT
0501	REP	2	LAST	84	13,2731	55∝626 0		TS	RRECTLEM
0502	REP	13	LAST	1286	13,2732	11∝500 1		CCS	DIFEQCNT
0503	REP	3	LAST	1266	13,2733	1 2725 1		TCF	MOVEALEM +1
0504	REP	65	LAST	1285	13,2734	0 6030 1		TC	DANZIG
R0505	PTOALEM				TRANSFERS RRECTLEM TO RRECTLEM +41 TO RRECT TO RRECT +41				
0506					13,2735	47014 1	PTOALEM	BON	RTB
0507	REP	4	LAST	261	13,2736	04307 1			SURFFLAG
0508	REP	1			13,2737	26756 1			USEPIOS
0509	REP	2	LAST	1229	13,2740	26745 0			MOVEPLEM
0510					13,2741	52014 0		BON	GOTO
0511	REP	5	LAST	1266	13,2742	04304 1			LMOONFLG
0512	REP	2	LAST	1285	13,2743	28673 1			SETMOON
0513	REP	1			13,2744	26666 0			CLRMOON
0514	REP	4	LAST	1286	13,2745	0 3015 0	MOVEPLEM	TC	SETBANK
0515	REP	14	LAST	1266	13,2746	55∝500 1		TS	DIFEQCNT
0516	REP	15	LAST	1286	13,2747	51∝500 0		INDEX	DIFEQCNT
0517	REP	3	LAST	1288	13,2750	3 1628 1		CA	RRECTLEM
0518	REP	16	LAST	1286	13,2751	51∝500 0		INDEX	DIFEQCNT
0519	REP	8	LAST	1286	13,2752	55∝502 1		TS	RRECT
0520	REP	17	LAST	1286	13,2753	11∝500 1		CCS	DIFEQCNT
0521	REP	3	LAST	1286	13,2754	1 2746 1		TCF	MOVEPLEM +1
0522	REP	66	LAST	1286	13,2755	0 6030 1		TC	DANZIG
0523					13,2756	77201 1	USEPIOS	SETPD	VLOAD
0524					13,2757	00001 0			0
0525	REP	10	LAST	1212	13,2760	02026 1			RLS
0526					13,2761	41525 0		PDDL	PUSH
0527	REP	49	LAST	1284	13,2762	00041 1			TDEC$_1$
0528	REP	12	LAST	668	13,2763	15517 0		STODL	TET
0529	REP	1			13,2764	27756 0			5/8

0530					13,2765	77624 1	CALL		
0531	REP	8	LAST	1206	13,2766	55341 1		RP-TO-R	
0532	REP	15	LAST	1252	13,2767	25535 0	STOVL	RCV	
0533	REP	2	LAST	32	13,2770	11450 0		ZUNIT	
0534					13,2771	14001 0	STODL	0D	
0535	REP	13	LAST	1266	13,2772	01517 0		TET	
0536					13,2773	14007 0	STODL	6D	
0537	REP	2	LAST	1266	13,2774	27756 0		5/8	
0538					13,2775	45014 0	SET	CALL	NEEDED FOR SETTING X1 ON EXIT
05381	REP	16	LAST	1266	13,2776	00063 1		MOONFLAG	
0539	REP	9	LAST	1267	13,2777	55341 1		RP-TO-R	
0540					13,3000	74235 0	VXV	VXSC	
0541	REP	16	LAST	1267	13,3001	01535 0		RCV	
0542	REP	1			13,3002	27014 0		OMEGMOON	
0543	REP	14	LAST	1252	13,3003	25543 1	STOVL	VCV	
0544	REP	8	LAST	1208	13,3004	11456 0		ZEROVEC	
0545	REP	6	LAST	1229	13,3005	01521 0	STORE	TDELTAV	
0546					13,3006	67174 1	AXT,2	SXA,2	
0547					13,3007	00002 0		2	
0548	REP	8	LAST	1265	13,3010	02150 1		PBODY	
0549	REP	8	LAST	1229	13,3011	35527 1	STCALL	TNUV	
0550	REP	1			13,3012	27136 0		A-PCHK	
0551					13,3013	07112 1	OMEGMOON	2DEC*	2.66169947 E-6 B+23*
0551					13,3014	06620 0			
0552	REP	1			13,3015	3 3021 1	SETBANK	CAP	INTBANK
0553	REP	30	LAST	1202	13,3016	54 006 0		TS	BBANK
0554	REP	1			13,3017	3 3436 0		CAP	FORTYONE
0555	REP	302	LAST	1204	13,3020	0 0002 0		TC	Q
0556	REP	9	LAST	1265	E3,1554			EBANK=	RRECTCSM
0557	REP	10	LAST	614	13,3021	26063 0	INTBANK	B3CON	INTEGRV

R0556 SPECIAL PURPOSE ENTRIES TO ORBITAL INTEGRATION. THESE ROUTINES PROVIDE ENTRANCES TO INTEGRATION WITH
R0560 APPROPRIATE SWITCHES SET OR CLEARED FOR THE DESIRED INTEGRATION.

R0561 CSMPREC AND LEMPREC PERFORM ORBIT INTEGRATION BY THE ENCKE METHOD TO THE TIME INDICATED IN TDEC1
R0563 ACCELERATIONS DUE TO OBLATENESS ARE INCLUDED. NO W-MATRIX INT. IS DONE.
R0564 THE PERMANENT STATE VECTOR IS NOT UPDATED.
R0565 CSMCONIC AND LEMCONIC PERFORM ORBIT INTEG. BY KEPLERS METHOD TO THE TIME INDICATED IN TDEC1
R0567 NO DISTURBING ACCELERATIONS ARE INCLUDED. IN THE PROGRAM FLOW THE GIVEN
R0566 STATE VECTOR IS RECTIFIED BEFORE SOLUTION OF KEPLERS EQUATION

R0569 THE ROUTINES ASSUME THAT THE CSM (LEM) STATE VECTOR IN P-MEM IS VALID.
R0570 SWITCHES SET PRIOR TO ENTRY TO THE MAIN INTEG. PROG ARE AS FOLLOWS

R0571		CSMPREC	CSMCONIC	LEMPREC	LEMCONIC
R0572	VINTFLAG	SET	SET	CLEAR	CLEAR
R0573	INTYPFLG	CLEAR	SET	CLEAR	SET
R0574	DIM0FLAG	CLEAR	CLEAR	CLEAR	CLEAR

L   INTEGRATION INITIALIZATION

R0575   CALLING SEQUENCE
R0576   L-X   STORE TDEC₁
R0577   L   CALL   (STCALL TDEC₁)
R0578   L+1   CSMPREC (CSMCONIC, LEMPREC, LEMCONIC)

R0579   NORMAL EXIT TO L+2
R0580   SUBROUTINES CALLED
R0581   INTEGRV1
R0582   PRECOUT FOR CSMPREC AND LEMPREC
R0583   CONICOUT FOR CSMCONIC AND LEMCONIC
R0584   OUTPUT - SEE PAGE 2 OF THIS LOG SECTION
R0585   INPUT
R0586   TDEC₁   TIME TO INTEGRATE TO . CSECS B-28

0587				13,3022	45020 1	CSMPREC	STO	CALL
0588	REF	81	LAST 1274	13,3023	00048 0			X1
0589	REF	23	LAST 1284	13,3024	27371 1			INTSTALL
0590				13,3025	43130 1		SXA,1	SET
0591	REF	2	LAST 87	13,3026	02214 1			IRETURN
0592	REF	10	LAST 601	13,3027	01474 1			VINTFLAG
0593				13,3030	43014 0	IFLAGP	SET	CLEAR
0594	REF	3	LAST 204	13,3031	01487 0			PRECIPLG
0595	REF	12	LAST 1284	13,3032	01878 1			DIM0FLAG
0596				13,3033	77814 1		CLRGO	
05961	REF	14	LAST 1284	13,3034	01833 0			INTYPFLG
05962	REF	1		13,3035	27115 1			INTEGRV1
0597				13,3036	45020 1	LEMPREC	STO	CALL
0598	REF	82	LAST 1288	13,3037	00048 0			X1
0599	REF	24	LAST 1288	13,3040	27371 1			INTSTALL
0600				13,3041	43130 1		SXA,1	CLRGO
0601	REF	3	LAST 1288	13,3042	02214 1			IRETURN
0602	REF	11	LAST 1288	13,3043	01834 1			VINTFLAG
0603	REF	1		13,3044	27030 1			IFLAGP
0604				13,3045	45020 1	CSMCONIC	STO	CALL
0605	REF	83	LAST 1288	13,3046	00046 0			X1
0606	REF	25	LAST 1288	13,3047	27371 1			INTSTALL
0607				13,3050	43130 1		SXA,1	SET
0608	REF	4	LAST 1288	13,3051	02214 1			IRETURN
0609	REF	12	LAST 1288	13,3052	01474 1			VINTFLAG
0610				13,3053	43014 0	IFLAGC	CLEAR	SETGO
0611	REF	13	LAST 1288	13,3054	01678 1			DIM0FLAG
0612	REF	15	LAST 1288	13,3055	01433 1			INTYPFLG
0613	REF	2	LAST 1288	13,3056	27115 1			INTEGRV1
0614				13,3057	45020 1	LEMCONIC	STO	CALL
0615	REF	84	LAST 1288 .	13,3060	00048 0			X1

0616	REP	26	LAST 1288	13,3061	27371 1			INTSTALL
0617				13,3062	43130 1		SXA,1	CLRGO
0618	REP	5	LAST 1288	13,3063	02214 1			IRETURN
0619	REP	13	LAST 1288	13,3064	01634 1			VINTFLAG
0620	REP	1		13,3065	27053 1			IFLAGC
0621				13,3066	66214 0	INTEGRVS	SET	SSP
0622	REP	4	LAST 1288	13,3067	01467 0			PRECIFLG
0623	REP	7	LAST 1287	13,3070	02151 0			PBODY
0624				13,3071	00000 1			0
0625				13,3072	66214 0		BOF	SSP
0626	REP	17	LAST 1287	13,3073	00343 0			MOONFLAG
0627				13,3074	27077 1			+3
0628	REP	8	LAST 1289	13,3075	02151 0			PBODY
06281				13,3076	00002 0			2
0629				13,3077	77220 1		STQ	VLOAD
0630	REP	6	LAST 1289	13,3100	02214 1			IRETURN
0631	REP	9	LAST 1287	13,3101	11456 0			ZEROVEC
0632	REP	7	LAST 1287	13,3102	01521 0		STORE	TDELTAV
0633	REP	7	LAST 1287	13,3103	35527 1		STCALL	TNUV
0634	REP	2	LAST 1229	13,3104	23344 0			RECTIFY
0635				13,3105	43014 0		CLEAR	SET
0636	REP	14	LAST 1288	13,3106	01676 1			DIM0FLAG
0637	REP	1		13,3107	04062 1			NEWIFLG
06371				13,3110	77614 1		SETGO	
06372	REP	1		13,3111	04020 1			RPQFLAG
0638	REP	1		13,3112	27127 0			ALOADED

R0639 INTEGRV IS AN ENTRY TO ORBIT INTEGRATION WHICH PERMITS THE CALLER ,
R0640 NORMALLY THE NAVIGATION PROGRAM ,TO SET THE INTEG. FLAGS. THE ROUTINE
R0641 IS ENTERED AT INTEGRV1 BY CSMPREC ET.AL. AND AT ALOADED BY INTEGRVS.
R0642 THE ROUTINE SETS UP A-MEMORY IF ENTERED AT INTEGRV,1 AND SETS THE INTEG.
R0643 PROGRAM FOR PRECISION OR CONIC

R0644 THE CALLER MUST FIRST CALL INTSTALL TO CHECK IF INTEG. IS IN USE BEFORE
R0645 SETTING ANY FLAGS.
R0646 THE FLAGS WHICH SHOULD BE SET OR CLEARED ARE
R0647   VINTFLAG   (IGNORED WHEN ENTERED FROM INTEGRVS)
R0648   INTYPFLG
R0649   DIM0FLAG
R0650   D6OR9FLG
R0651 CALLING SEQUENCE
R0652   L-X   CALL
R0653   L-Y   INTSTALL
R0654   L-1   SET OR CLEAR ALL FOUR FLAGS. ALSO CAN SET STATEFLG IF DESIRED
R0655   AND DIM0FLAG IS CLEAR.
R0656   L   CALL
R0657   L+1   INTEGRV
R0658 INITIALIZATION
R0659   FLAGS AS ABOVE
R0660   STORE TIME TO INTEGRATE TO IN TDEC1

R0661	OUTPUT							
R0662	RATT	AS						
R0663	VATT		DEFINED					
R0664	TAT		BEFORE					
0665				13,3113	77620 0	INTEGRV	STQ	
0666	REF	7	LAST 1289	13,3114	02214 1			1RETURN
0667				13,3115	43014 0	INTEGRV1	SET	SET
0668	REF	2	LAST 1289	13,3116	04060 0			RPQFLAG
0669	REF	2	LAST 1289	13,3117	04062 1			NEW1FLG
0670				13,3120	77731 1	INTEGRV2	SSP	
0671	REF	21	LAST 1230	13,3121	00053 1			QPRET
0672	REF	2	LAST 1269	13,3122	27127 0			ALOADED
0673				13,3123	52014 0		BON	GOTO
0674	REF	14	LAST 1289	13,3124	01714 0			VINTFLAG
0675	REF	2	LAST 259	13,3125	26662 1			PTOACSM
0676	REF	1		13,3126	26735 1			PTOALEM
0677				13,3127	77745 1	ALOADED	DLOAD	
0678	REF	50	LAST 1288	13,3130	00041 1			TDEC1
0679	REF	2	LAST 76	13,3131	01101 0		STORE	TDEC
0680				13,3132	52014 0		BOFF	GOTO
0681	REF	16	LAST 1288	13,3133	01753 1			INTYPFLG
0682	REF	1		13,3134	27234 1			TESTLOOP
0683	REF	1		13,3135	27220 1			RVCON
0684				13,3136	77414 0	A-PCHK	BOFCLR EXIT	
0685	REF	5	LAST 1284	13,3137	01852 1			STATEFLG
0686	REF	1		13,3140	27157 1			RECTOUT
0687	REF	95	LAST 1284	13,3141	0 5301 0		TC	PHASCHNG
0688				13,3142	04022 0		OCT	04022
0689	REF	49	LAST 1227	13,3143	0 5435 0		TC	UPFLAG
0690	REF	3	LAST 1227	13,3144	00238 0		ADRES	REINTFLG
0692	REF	234	LAST 1263	13,3145	0 8006 1		TC	INTPRET
0693				13,3146	77731 1		SSP	
0694	REF	22	LAST 1290	13,3147	00053 1			QPRET
0695	REF	1		13,3150	27155 0			PHEXIT
0696				13,3151	52014 0		BON	GOTO
0697	REF	15	LAST 1290	13,3152	01714 1			VINTFLAG
0698	REF	2	LAST 32	13,3153	26636 0			ATOPCSM
0699	REF	2	LAST 32	13,3154	26711 1			ATOPLEM
0700				13,3155	77824 1	PHEX1T	CALL	
0701	REF	22	LAST 1230	13,3156	56741 0			GRP2PC
0702				13,3157	45001 1	RECTOUT	SETPD	CALL
0703				13,3160	00001 0			0
0704	REF	3	LAST 1289	13,3161	23344 0			RECTIFY
0705				13,3162	53775 1		VLOAD	VSL*
0706	REF	9	LAST 1288	13,3163	01503 0			RRECT
0707				13,3164	57576 1			0,2
0708				13,3165	53715 1		PDVL	VSL*
0709	REF	8	LAST 1252	13,3166	01511 0			VRECT

PHASE CHANGE HAS OCCURRED BETWEEN
INTSTALL AND INTWAKE

RATT TO PD0

L   INTEGRATION INITIALIZATION   USER∝S PAGE NO. 13   E3 S3

0710				13,3167	57576 1			0,2	
0711				13,3170	63325 0		PDDL	PDVL	VATT TO PD6 TAT TO PD12
0712	REP	14	LAST 1287	13,3171	01517 0			TET	
0713	REP	10	LAST 1290	13,3172	01503 0			RRECT	
0714				13,3173	64715 0		PDVL	PDDL*	
0715	REP	7	LAST 1290	13,3174	01511 0			VRECT	
0716	REP	2	LAST 480	13,3175	50041 1			MUEARTH,2	
0717				13,3176	76008 0		PUSH	.AXT,1	
0718				13,3177	77765 0		DEC	-10	
0719				13,3200	76014 0		BON	AXT,1	
0720	REP	18	LAST 1289	13,3201	00303 1			MOONFLAG	
0721				13,3202	27204 1			+2	
0722				13,3203	77775 1		DEC	-2	
0723				13,3204	40001 1	INTEXIT	SETPD	BOV	
0724				13,3205	00001 0			0	
0725				13,3206	27207 1			+1	
07251				13,3207	43014 0		CLEAR	CLEAR	
07252	REP	2	LAST 284	13,3210	04678 1			AVEMIDSW	ALLOW UPDATE OF DOWNLINK STATE VECTOR
07253	REP	5	LAST 1289	13,3211	01887 1			PRECIFLG	
0726				13,3212	77535 1		SLOAD	EXIT	
0727	REP	8	LAST 1290	13,3213	02215 0			IRETURN	
0728	REP 853		LAST 1289	13,3214	3 0154 1		CA	MPAC	
0729	REP	38	LAST 1257	13,3215	50 120 1		INDEX	FIXLOC	
0730	REP	23	LAST 1290	13,3216	54 052 1		TS	QPRET	
0731	REP	4	LAST 1230	13,3217	0 3408 0		TC	INTWAKE	

R0732   RVCON SETS UP ORBIT INTEGRATION TO DO A CONIC SOLUTION FOR POSITION AND
R0733   VELOCITY FOR THE INTERVAL (TET-TDEC)

0734				13,3220	45345 1	RVCON	DLOAD	DSU
0735	REP	3	LAST 1290	13,3221	01101 0			TDEC
0736	REP	15	LAST 1291	13,3222	01517 0			TET
0737	REP	7	LAST 1249	13,3223	36312 1		STCALL	TAU
0738	REP	4	LAST 1290	13,3224	23344 0			RECTIFY
0739				13,3225	77624 1		CALL	
0740	REP	1		13,3226	22310 0			KEPPREP
0741				13,3227	43345 1		DLOAD	DAD
0742	REP	8	LAST 1252	13,3230	01551 1			TC
0743	REP	16	LAST 1291	13,3231	01517 0			TET
0744	REP	17	LAST 1291	13,3232	35517 1		STCALL	TET
0745	REP	2	LAST 1290	13,3233	27157 1			RECTOUT

P07455   TESTLOOP

0746				13,3234	43014 0	TESTLOOP BOF	CLRGO	
07462	REP	4	LAST 1284	13,3235	04752 0		QUITFLAG	
07463				13,3236	27241 0		+3	
07464	REP	6	LAST 1290	13,3237	01632 1		STATEFLG	
07465	REP	1		13,3240	27204 1		INTEXIT	STOP INTEGRATION
07466				13,3241	73001 1	+3 SETPD	LXA,2	
0747				13,3242	00013 0		10D	
0748	REP	9	LAST 1289	13,3243	02150 1		PBODY	
0749				13,3244	51575 1	VLOAD	ABVAL	
0750	REP	17	LAST 1287	13,3245	01535 0		RCV	
0751				13,3246	43006 0	PUSH	CLEAR	RC TO 10D
0752	REP	1		13,3247	00262 1		MIDFLAG	
0753				13,3250	50023 0	DSU*	RMN	MIDFLAG=0 IF R G.T. RMP
0754	REP	1		13,3251	67241 1		RME,2	
0755				13,3252	27255 0		+3	
0756				13,3253	77614 1	SET		
0757	REP	2	LAST 1292	13,3254	00062 0		MIDFLAG	
0758				13,3255	41345 0	NORFINAL DLOAD	DMP	
0759				13,3256	00013 0		10D	
0760				13,3257	00043 0		34D	
0761				13,3260	55762 1	SR_1R	DDV*	
0762	REP	3	LAST 1291	13,3261	50041 1		MUEARTH,2	
0763				13,3262	41366 1	SQRT	DMP	
0764	REP	1		13,3263	23675 1		.3D	
0765				13,3264	40442 1	$SR3$	SR4	DT IS TRUNCATED TO A MULTIPLE
0766				13,3265	54345 1	DLOAD	SL	
0767	REP	654	LAST 1291	13,3266	00155 0		MPAC	
0768				13,3267	20220 0		15D	OF 128 CSECS.
0769				13,3270	40006 0	PUSH	BOV	
0770	REP	1		13,3271	27316 0		MAXDT	
0771				13,3272	50021 1	RDSU	RMN	
0772	REP	1		13,3273	27370 0		DT/2MAX	
0773	REP	2	LAST 1292	13,3274	27316 0		MAXDT	
0774				13,3275	45345 1	DT/2COMP DLOAD	DSU	
0775	REP	4	LAST 1291	13,3276	01101 0		TDEC	
0776	REP	18	LAST 1291	13,3277	01517 0		TET	
0777				13,3300	54234 0	RTB	SL	
0778	REP	4	LAST 715	13,3301	45541 0		SGNAGREE	
0779				13,3302	20211 1		8D	
0780	REP	2	LAST 88	13,3303	02314 0	STORE	DT/2	B-19
0781				13,3304	51400 1	BOV	ABS	
0782	REP	1		13,3305	27322 1		GETMAXDT	
0783				13,3306	50025 0	DSU	RMN	IS TIME TO INTEG. TO GR THAN MAXTIME
0784				13,3307	00015 0		12D	
0785	REP	1		13,3310	27326 0		POOHCHK	
0786				13,3311	75345 1	USEMAXDT DLOAD	SIGN	
0787				13,3312	00015 0		12D	
0788	REP	3	LAST 1292	13,3313	02314 0		DT/2	

L   INTEGRATION INITIALIZATION   USER=S PAGE NO. 15   E3 S3

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0789    REP    4  LAST 1292    13,3314    38314 1              STCALL DT/2
0790    REP    2  LAST 1292    13,3315    27328 0                     POOHCHK
0791                           13,3316    65345 0    MAXDT    DLOAD   PDDL         EXCHANGE DT/2MAX WITH COMPUTED MAX.
0792    REP    2  LAST 1292    13,3317    27370 0                     DT/2MAX
0793                           13,3320    77650 1              GOTO
0794    REP    1               13,3321    27275 1                     DT/2COMP
0795                           13,3322    77634 0    GETMAXDT RTB
0796    REP   15  LAST  828    13,3323    45707 0                     SIGNMPAC
0797    REP    5  LAST 1293    13,3324    36314 1              STCALL DT/2
0798    REP    1               13,3325    27311 1                     USEMAXDT
0799                           13,3326    51545 1    POOHCHK  DLOAD   ABS
0800    REP    6  LAST 1293    13,3327    02314 0                     DT/2
0801                           13,3330    50025 0              DSU     BMN
0802    REP    1               13,3331    27366 1                     DT/2MIN
0803    REP    2  LAST 1287    13,3332    27138 0                     A-PCHK
0804                           13,3333    46135 1              SLOAD   BHIZ
0805    REP   13  LAST  711    13,3334    01012 0                     MODREG
0806                           13,3335    27340 0                     +3
0807                           13,3336    77850 0              GOTO
0808    REP    1.              13,3337    23155 1                     TIMESTEP
08081                          13,3340    77814 1              BON             WAS THIS CALL VIA CSM(LEM)PREC
08082   REP    6  LAST 1291    13,3341    01707 0                     PRECIFLG
08083   REP    2  LAST 1293    13,3342    23155 1                     TIMESTEP     YES
0809                           13,3343    45345 1              DLOAD   DSU
0810    REP    7  LAST 1293    13,3344    02314 0                     DT/2
0811                           13,3345    00015 0                     12D
0812                           13,3346    43040 1              BMN     BOFCLR
0813    REP    3  LAST 1293    13,3347    27138 0                     A-PCHK
0814    REP    3  LAST 1290    13,3350    04242 1                     NEWIFLG
0815    REP    3  LAST 1293    13,3351    23155 1                     TIMESTEP
0816                           13,3352    45345 1              DLOAD   DSU
0817    REP    5  LAST 1292    13,3353    01101 0                     TDEC
0818    REP   19  LAST 1292    13,3354    01517 0                     TET
08181                          13,3355    77840 0              BMN             NO BACKWARD INTEGRATION
08182   REP    2  LAST 1292    13,3356    27204 1                     INTEXIT
0819                           13,3357    40525 1              PDDL    SR4
0820    REP    8  LAST 1293    13,3360    02314 0                     DT/2         IS 4(DT) LS(TDEC - TET)
0821                           13,3361    44322 1              SR2R    BDSU         NO
0822                           13,3362    52040 1              BMN     GOTO
0823    REP    3  LAST 1293    13,3363    27204 1                     INTEXIT
0824    REP    4  LAST 1293    13,3364    23155 1                     TIMESTEP
0825                           13,3365    00000 1    DT/2MIN  2DEC    3 B-20
0826                           13,3366    01400 1
0828                           13,3367    14152 1    DT/2MAX  2DEC    4000 E2 B-20
0828                           13,3370    00000 1
0828                           13,3371    77778 1    INTSTALL EXIT
0829    REP  250  LAST 1226    13,3372    3 4714 1              CAF     ZERO
0830    REP  209  LAST 1201    13,3373    54 001 1    ALLSTALL TS      L
0831    REP    5  LAST  184    13,3374    3 0108 0              CA      RASFLAG
0832    REP  210  LAST 1293    13,3375    50 001 0              INDEX   L
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L   INTEGRATION INITIALIZATION

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0833    REF    1                   13,3376   7 3467 0              MASK    INTBITAB      IS THIS STALL AREA FREE
0834                                13,3377   0 0006 1              EXTEND
0835    REF    1                   13,3400   1 3445 0              BZF     OKTOGRAB      YES
0836    REF  211   LAST 1293       13,3401   50 001 0              INDEX   L
0837.   REF    1                   13,3402   3 3464 1              CAF     WAKESTAL
0838    REF    4   LAST  417       13,3403   0 5070 0              TC      JOBSLEEP
0839                                13,3404    77776 1   INTWAKE0  EXIT
08395   REF    2   LAST  504       13,3405   1 3426 0              TCF     INTWAKE1

0840    REF    6   LAST 1293       13,3406   4 0106 1   INTWAKE   CS      RASFLAG       IS THIS INTSTALLED ROUTINE TO BE
0841    REF    1                   13,3407   7 4704 1              MASK    REINTBIT         RESTARTED
0842    REF  340   LAST 1199       13,3410   10 000 0              CCS     A
0843.   REF    3   LAST 1294       13,3411   0 3426 1              TC      INTWAKE1      NO

0844    REF   39   LAST 1291       13,3412   50 120 1              INDEX   PIXLOC
0845    REF   24   LAST 1291       13,3413   3 0052 0              CA      QPRET
0848    REF    1                   13,3414   55=055 1              TS      TBASE2        YES, DONT RESTART WITH SOMEONE ELSES Q

0849    REF   96   LAST 1290       13,3415   0 5301 0              TC      PHASCHNG
0850                                13,3416    04022 0              OCT     04022

0851    REF    2   LAST 1294       13,3417   3 1055 0              CA      TBASE2
0852    REF   40   LAST 1294       13,3420   50 120 1              INDEX   PIXLOC
0853    REF   25   LAST 1294       13,3421   54 052 1              TS      QPRET

0854    REF    2   LAST 1294       13,3422   3 4704 0              CAF     REINTBIT
0855    REF    7   LAST 1294       13,3423   7 0106 1              MASK    RASFLAG
0856                                13,3424   0 0006 1              EXTEND
0857    REF    1                   13,3425   1 3450 1              BZF     GOBAC         DONT INTWAKE IF WE CAME HERE VIA RESTART

0858    REF  251   LAST 1293       13,3426   3 4714 1   INTWAKE1  CAF     ZERO
0859    REF    1                   13,3427   54 154 0   WAKE      TS      STALTEM       INDEX OF ANY STALL USER
0860    REF    2   LAST 1294       13,3430   50 154 1   WAKE1     INDEX   STALTEM
0861    REF    2   LAST 1294       13,3431   3 3464 1              CAF     WAKESTAL
0862                                13,3432   0 0004 0              INHINT
0863    REF    5   LAST  417       13,3433   0 5074 1              TC      JOBWAKE
0864    REF   22   LAST 1186       13,3434   10 064 1              CCS     LOCCTR
0865    REF    1                   13,3435   1 3430 1              TCF     WAKE1         MAY BE MORE TO WAKE UP
0866                                13,3436    00051 0   FORTYONE  DEC     41
0867    REF    3   LAST 1294       13,3437   50 154 1              INDEX   STALTEM
0868    REF    2   LAST 1294       13,3440   4 3467 0              CS      INTBITAB
0869    REF    8   LAST 1294       13,3441   7 0106 1              MASK    RASFLAG
0870    REF    9   LAST 1294       13,3442   54 106 1              TS      RASFLAG       RELEASE STALL AREA
0871                                13,3443   0 0003 1              RELINT
0872    REF    2   LAST 1294       13,3444   1 3450 1              TCF     GOBAC
0873    REF  212   LAST 1294       13,3445   50 001 0   OKTOGRAB  INDEX   L             NO, WAIT UNTIL AVAILABLE
0874    REF    2   LAST  183       13,3446   3 4675 1              CAF     INTFLBIT
0875    REF   10   LAST 1294       13,3447   26 106 1              ADS     RASFLAG
0876    REF  235   LAST 1290       13,3450   0 6006 1   GOBAC     TC      INTPRET
0877                                13,3451    77616 0              RVQ
```

0878				13,3452	77776 1	ERASTAL1	EXIT
0879	REP	154	LAST 1257	13,3453	3 4712 1		CAP	ONE
0880	REP	1		13,3454	1 3373 1		TCP	ALLSTALL
0881				13,3455	77776 1	ERASTAL2	EXIT
0882	REP	66	LAST 1204	13,3456	3 4711 1		CAP	TWO
0883	REP	2	LAST 1295	13,3457	1 3373 1		TCP	ALLSTALL
0884	REP	155	LAST 1295	13,3460	3 4712 1	ERASWAK1	CAP	ONE
0885	REP	1		13,3461	1 3427 1		TCP	WAKE
0886	REP	67	LAST 1295	13,3462	3 4711 1	ERASWAK2	CAP	TWO
0887	REP	2	LAST 1295	13,3463	1 3427 1		TCP	WAKE
0888	REP	27	LAST 1289	13,3464	27372 1	WAKESTAL	CADR	INTSTALL +1
0889	REP	1		13,3465	27453 0		CADR	ERASTAL1 +1
0890	REP	1		13,3466	27456 0		CADR	ERASTAL2 +1
0891	REP	655	LAST 1292	0154		STALTEM	EQUALS	MPAC
0892				13,3467	20100 1	INTBITAB	OCT	20100
0893				13,3470	10040 1		OCT	10040
0894				13,3471	04020 1		OCT	04020

L   INTEGRATION INITIALIZATION

P0895   AVETOMID

R0896   THIS ROUTINE PERFORMS THE TRANSITION FROM A THRUSTING PHASE TO THE COAST
R0897   PHASE BY INITIALIZING THIS VEHICLES PERMANENT STATE VECTOR WITH THE
R0898   VALUES LEFT BY THE AVERAGEG ROUTINE IN RN,VN,PIPTIME.

R0899   BEFORE THIS IS DONE THE W-MATRIX, IF ITS VALID (ORWFLAG OR RENDWFLG IS
R0900   SET) IS INTEGRATED FORWARD TO PIPTIME WITH THE PRE-THRUST STATE VECTOR.

R0901   IN ADDITION, THE OTHER VEHICLE IS INTEGRATED (PERMANENT) TO PIPTIME.

R0902   FINALLY TRKMKCNT IS ZEROED

Line	REF		LAST		Addr	Code		Label	Op	Operand	Comment
0903	REF	3	LAST	1283	13,2000				SETLOC	INTINIT	
0904					13,3472				BANK		
0905	REF	3	LAST	1283 TO 1296'	457 487*			COUNT*	SS/INTIN		
0906					13,3472	43020	1	AVETOMID	STQ	BON	
0907	REF	14	LAST	1230	13,3473	02317	0			EGRESS	
0908	REF	10	LAST	624	13,3474	02716	0			RENDWFLG	
0909	REF	1			13,3475	27550	1			INT/W	W-MATRIX VALID ,GO INTEGRATE IT
0910					13,3476	77614	1		BON		
0911	REF	12	LAST	623	13,3477	01711	1			ORBWFLAG	
0912	REF	2	LAST	1296	13,3500	27550	1			INT/W	W-MATRIX VALID ,GO INTEGRATE IT
0913					13,3501	77614	1	OTHERS	BON		FOR
09131	REF	5	LAST	1286	13,3502	04307	1			SURFFLAG	CSM
09132	REF	1			13,3503	27520	0			SETCOAST	DONT DO LM ONLY
09133					13,3504	45145	0		DLOAD	CALL	GET SET FOR NON W-MAT PERMANENT INTEG.
0914	REF	16	LAST	1039	13,3505	01205	1			PIPTIME	DESIRED TIME
0915	REF	28	LAST	1295	13,3506	27371	1			INTSTALL	
0916					13,3507	45014	0		SET	CALL	
0917	REF	16	LAST	1290	13,3510	01474	1			VINTFLAG	CM
0918	REF	3	LAST	1284	13,3511	26621	0			SETIFLGS	SETS UP NONE W-MAT. PERMANENT INTEG.
0919					13,3512	43014	0		BOF	CLEAR	
0920	REF	3	LAST	485	13,3513	02747	1			COMPUTER	
0921					13,3514	27516	0			+2	COMPUTER IS LM , INTEG CM
0922	REF	17	LAST	1296	13,3515	01674	0			VINTFLAG	COMPUTER IS CM , INTEG LM
0923	REF	51	LAST	1290	13,3516	34041	0		STCALL	TDEC1	
0924	REF	11	LAST	1267	13,3517	27113	1			INTEGRV	
0925					13,3520	45174	1	SETCOAST	AXT,2	CALL	NOW MOVE PROPERLY SCALED RN,VN AND
0926					13,3521	00002	0			2	PIPTIME TO INTEGRATION ERASABLES.
0927	REF	29	LAST	1296	13,3522	27371	1			INTSTALL	
0928					13,3523	77014	1		BON	AXT,2	
0929	REF	9	LAST	1229	13,3524	04303	0			MOONTHIS	
0930					13,3525	27527	1			+2	
0931					13,3526	00000	1			0	
0932					13,3527	53775	1		VLOAD	VSR*	

0933	REP	16	LAST	790	13,3530	01171 1			RN	
0934					13,3531	57176 0			0,2	
0935	REP	11	LAST	1291	13,3532	01503 0		STORE	RRECT	
0936	REP	16	LAST	1292	13,3533	15535 0		STODL	RCV	
0937	REP	17	LAST	1296	13,3534	01205 1			PIPTIME	
0938	REP	20	LAST	1293	13,3535	25517 0		STOVL	TET	
0939	REP	16	LAST	641	13,3536	01177 1			VN	
0940					13,3537	45057 1		VSR*	CALL	
0941					13,3540	57176 0			0,2	
0942	REP	2	LAST	503	13,3541	23360 0			MINIRECT	FINISH SETTING UP STATE VECTOR
0943					13,3542	86234 1		RTB	SSP	
0944	REP	1			13,3543	28651 1			MOVATHIS	PUT TEMP STATE VECTOR INTO PERMANENT
0945	REP	6	LAST	850	13,3544	01127 1			TRKMKCNT	
0946					13,3545	00000 1			0	
0947					13,3546	77650 1		GOTO		
0948	REP	2	LAST	1230	13,3547	75745 0			PAZAB5	
0949					13,3550	45145 0	INT/W	DLOAD	CALL	
0950	REP	16	LAST	1297	13,3551	01205 1			PIPTIME	INTEGRATE W THRU BURN
0951	REP	30	LAST	1296	13,3552	27371 1			INTSTALL	
0952					13,3553	43014 0		SET	SET	
0953	REP	15	LAST	1289	13,3554	01476 0			DIM0FLAG	DO W-MATRIX
0954	REP	3	LAST	1291	13,3555	04476 0			AVEMIDSW	SO WONT CLOBBER RN,VN,PIPTIME
0955					13,3556	43014 0		SET	CLEAR	
0956	REP	8	LAST	1284	13,3557	01475 0			D6OR9FLG	9X9 FOR LM
0957	REP	16	LAST	1296	13,3560	01674 0			VINTFLAG	LM
0958					13,3561	43014 0		BOP	SET	
0959	REP	4	LAST	1296	13,3562	02747 1			COMPUTER	
0960					13,3563	27567 0			+4	LM TO DO
0961	REP	19	LAST	1297	13,3564	01474 1			VINTFLAG	
0962					13,3565	77614 1		CLEAR		
0963	REP	7	LAST	1297	13,3566	01675 1			D6OR9FLG	6X6 FOR CM
0964	REP	52	LAST	1296	13,3567	34041 0		STCALL	TDEC1	
0965	REP	12	LAST	1296	13,3570	27113 1			INTEGRV	
0966					13,3571	77650 1		GOTO		
0967	REP	1			13,3572	27501 0			OTHERS	NOW GO DO THE OTHER VEHICLE

L   INTEGRATION INITIALIZATION

P0968   MIDTOAV1

R0969   THIS ROUTINE INTEGRATES (PRECISION) TO THE TIME SPECIFIED IN TDEC1.
R0970   IF, AT THE END OF AN INTEGRATION TIME STEP, CURRENT TIME PLUS A DELTA
R0971   TIME (SEE TIMEDELT.....BASED ON THE COMPUTATION TIME FOR ONE TIME STEP)
R0972   IS GREATER THAN THE DESIRED TIME, ALARM 1703 IS SET AND THE INTEGRATION
R0973   IS DONE TO THE CURRENT TIME.
R0974   RETURN IS IN BASIC TO THE RETURN ADDRESS PLUS ONE.

R0975   IF THE INTEGRATION IS FINISHED TO THE DESIRED TIME, RETURN IS IN BASIC
R0976   TO THE RETURN ADDRESS

R0977   IN EITHER CASE , BEFORE RETURNING, THE EXTRAPOLATED STATE VECTOR IS TRAN
R0978   FERRED FROM R,VATT TO R,VN1-PIPTIME1 IS SET TO THE FINISHING INTEGRA-
R0979   TION TIME AND MPAC IS SET TO THE DELTA TIME---
R0980   TAT MINUS CURRENT TIME.
R0981   MIDTOAV2

R0982   THIS ROUTINE INTEGRATES THIS VEHICLES STATE VECTOR TO THE CURRENT TIME.
R0983   NO INPUTS ARE REQUIRED OF THE CALLER. RETURN IS IN BASIC TO THE RETURN
R0984   ADDRESS WITH THE ABOVE TRANSFERS TO R,VN1-PIPTIME1-AND MPAC DONE

0985	REP	2	LAST	78	1127		EBANK= IRETURN1
0988					13,3573	43020 1	MIDTOAV2 STQ CLRGO	INTEGRATE TO PRESENT TIME PLUS TIMEDELT
0987	REP	3	LAST 1298		13,3574	01127 1	IRETURN1
0988	REP	1			13,3575	04834 1	MID1FLAG
0989	REP	1			13,3576	27612 1	ENTMID2
0990					13,3577	43020 1	MIDTOAV1 STQ SET	INTEGRATE TO TDEC1
0991	REP	4	LAST 1298		13,3800	01127 1	IRETURN1
0992	REP	2	LAST 1298		13,3801	04474 1	MID1FLAG
0993					13,3602	43234 0	RTB DAD	INITIAL CHECK, IS TDEC1 IN THE FUTURE
0994	REP	27	LAST 1283		13,3603	45505 0	LOADTIME
0995	REP	1			13,3604	27714 0	TIMEDELT
0998					13,3805	51021 0	BDSU BPL
0997	REP	53	LAST 1297		13,3806	00041 1	TDEC1
0998	REP	1			13,3807	27818 0	ENTMID1	Y5 S
0999					13,3610	77624 1	CALL
1000	REP	1			13,3811	27702 1	NOTIME	NO, SET ALARM, SWITCH TO MIDTOAV2
1001					13,3612	43234 0	ENTMID2 RTB DAD
1002	REP	28	LAST 1298		13,3813	45505 0	LOADTIME
1003	REP	2	LAST 1298		13,3814	27714 0	TIMEDELT
1004	REP	54	LAST 1298		13,3815	00041 1	STORE TDEC1
1005					13,3818	77624 1	ENTMID1 CALL
1008	REP	31	LAST 1297		13,3817	27371 1	INTSTALL
1007					13,3820	45014 0	CLEAR CALL

L   INTEGRATION INITIALIZATION   USER=S PAGE NO. 21   E2 S3

1008	REP	16	LAST 1297	13,3621	01676 1			DIM0FLAG	NO W-MATRIX
1009	REP	1		13,3622	26034 1			THISVINT	
1010				13,3623	43014 0		CLEAR	SET	
1011	REP	17	LAST 1290	13,3624	01673 1			INTYPFLG	
1012	REP	1		13,3625	04475 0			MIDAVFLG	LET INTEG. KNOW THE CALL IS FOR MIDTOAV.
1013				13,3626	77624 1		CALL		
1014	REP	13	LAST 1297	13,3627	27113 1			INTEGRV	GO INTEGRATE
1015				13,3630	77214 0		CLEAR	VLOAD	
1016	REP	2	LAST 1299	13,3631	04675 1			MIDAVFLG	
1017	REP	37	LAST 887	13,3632	00001 0			RATT	
1018	REP	9	LAST 790	13,3633	25232 0		STOVL	RN1	
1019	REP	24	LAST 669	13,3634	00007 0			VATT	
1020	REP	4	LAST 790	13,3635	15240 0		STODL	VN1	
1021	REP	11	LAST 669	13,3636	00015 0			TAT	
1022	REP	8	LAST 766	13,3637	01246 0		STORE	PIPTIME1	
10221				13,3640	66134 1		SXA,2	SXA,1	
10222	REP	15	LAST 769	13,3641	03746 1			RTX2	
10223	REP	11	LAST 666	13,3642	03745 1			RTX1	
1023				13,3643	77776 1		EXIT		
1024				13,3644	0 0004 0		INHINT		
1025				13,3645	0 0006 1		EXTEND		
1026	REP	28	LAST 1066	13,3646	4 0025 1		DCS	TIME2	
1027	REP	656	LAST 1295	13,3647	20 155 1		DAS	MPAC	
1028	REP	10	LAST 1132	13,3650	0 7226 0		TC	TPAGREE	
1029	REP	5	LAST 1296	13,3651	3 1127 1		CA	IRETURN1	
1030	REP	7	LAST 565	13,3652	0 4577 0		TC	BANKJUMP	
1031				13,3653	47014 1	CKMID2	BOF	RTB	
1032	REP	3	LAST 1296	13,3654	04754 0			MID1FLAG	
1033	REP	1		13,3655	27672 1			MID2	
1034	REP	29	LAST 1296	13,3656	45505 0			LOADTIME	
1035				13,3657	44215 1		DAD	BDSU	
1036	REP	3	LAST 1296	13,3660	27714 0			TIMEDELT	
1037	REP	6	LAST 1293	13,3661	01101 0			TDEC	
1038				13,3662	45044 0		BPL	CALL	
1039	REP	2	LAST 1290	13,3663	27234 1			TESTLOOP	YES
1040	REP	2	LAST 1296	13,3664	27702 1			NOTIME	
1041				13,3665	43234 0	TIMEINC	RTB	DAD	
1042	REP	30	LAST 1299	13,3666	45505 0			LOADTIME	
1043	REP	4	LAST 1299	13,3667	27714 0			TIMEDELT	
1044	REP	7	LAST 1299	13,3670	35101 1		STCALL	TDEC	
1045	REP	3	LAST 1299	13,3671	27234 1			TESTLOOP	
1046				13,3672	45345 1	MID2	DLOAD	DSU	
1047	REP	6	LAST 1299	13,3673	01101 0			TDEC	
1048	REP	21	LAST 1297	13,3674	01517 0			TET	
1049				13,3675	45246 0		ABS	DSU	
1050	REP	1		13,3676	27712 0			3CSECS	

1051				13,3677	52040 1		BMN	GOTO
1052	REP	4	LAST 1293	13,3700	27136 0			A-PCHK
1053	REP	1		13,3701	27665 1			TIMEINC
1054				13,3702	77414 0	NOTIME	CLEAR	EXIT
1055	REP	4	LAST 1299	13,3703	04674 0			MID1FLAG
1056	REP	6	LAST 1299	13,3704	25=127 1		INCR	IRETURN1
1057	REP	34	LAST 1161	13,3705	0 5537 0		TC	ALARM
1058				13,3706	01703 1		OCT	1703
1059	REP	236	LAST 1294	13,3707	0 6006 1		TC	INTPRET
1060				13,3710	77616 0		RVQ	

TOO LATE

SET ERROR EXIT (CALLOC +2)
INSUFFICIENT TIME FOR INTEGRATION --
   TIG WILL BE SLIPPED...

1061				13,3711	00000 1	3CSECS	2DEC	3
1061				13,3712	00003 1			
1062				13,3713	00000 1	TIMEDELT	2DEC	1250
1062				13,3714	02342 0			
1063				27,2662			BANK	27
1064	REP	1		27,2000			SETLOC	UPDATE2
1065				27,2662			BANK	
1066	REP	1		0330			EBANK=	INTWAKUO
1067	REP	1					COUNT*	SS/INTIN
1068	REP	1		0330		INTWAKUO =		INTWAK1O

TEMPORARY UNTIL NAME OF INTWAK1O IS CHNG

1069				27,2662	0 0003 1	INTWAKEU	RELINT	
1070				27,2663	0 0006 1		EXTEND	
1071	REP	2	LAST 1300	27,2664	22 330 1		QXCH	INTWAKUO

SAVE Q FOR RETURN

1072	REP	237	LAST 1300	27,2665	0 6006 1		TC	INTPRET

1073				27,2666	53135 0		SLOAD	BZE
1074	REP	3	LAST 179	27,2667	01502 1			UPSVFLAG
1075	REP	1		27,2670	56727 0			INTWAKUP

IS THIS A CSM/LEM STATE VECTOR UPDATE
REQUEST. IF NOT GO TO INTWAKUP.

1076				27,2671	77775 1		VLOAD	
1077	REP	12	LAST 1297	27,2672	01503 0			RRECT
1076	REP	19	LAST 1297	27,2673	25535 0		STOVL	RCV
1079	REP	6	LAST 1291	27,2674	01511 0			VRECT
1060				27,2675	77624 1		CALL	
1061	REP	5	LAST 1291	27,2676	23361 1			RECTIFY +13D
1062				27,2677	51535 0		SLOAD	ABS
1063	REP	4	LAST 1300	27,2700	01502 1			UPSVFLAG
1084				27,2701	53025 0		DSU	BZE
1085	REP	1		27,2702	16740 0			UPMNSVCD
1086	REP	1		27,2703	56710 1			INTWAKEM
1087				27,2704	43174 1	AXT,2	CLRGO	
1066				27,2705	00000 1	DEC	0	
1089	REP	19	LAST 1291	27,2706	00223 1			MOONFLAG

MOVE RRECT(6) AND VRECT(6) INTO
     RCV(6)   AND VCV(6)   RESPECTIVELY.

NOW GO TO =RECTIFY +13D= TO
STORE VRECT INTO VCV AND ZERO OUT
TDELTAV(6),TNUV(6),TC(2) AND XKEP(2)
COMPARE ABSOLUTE VALUE OF =UPSVFLAG=
TO =UPDATE MOON STATE VECTOR CODE=
TO DETERMINE WHETHER THE STATE VECTOR TO
BE UPDATED IS IN THE EARTH OR LUNAR
SPHERE OF INFLUENCE.........
EARTH SPHERE OF INFLUENCE.

L   INTEGRATION INITIALIZATION

1090	REP	1			27,2707	56713 1			INTWAKEC
1091					27,2710	43174 1	INTWAKEM	AXT,2	SET
1092					27,2711	00002 0		DEC	2
1093	REP	20	LAST	1300	27,2712	00063 1			MOONFLAG
1094					27,2713	50135 0	INTWAKEC	SLOAD	BMN
A1095									
1096	REP	5	LAST	1300	27,2714	01502 1			UPSVFLAG
1097	REP	1			27,2715	56723 1			INTWAKLM
1098					27,2716	77624 1		CALL	
1099	REP	3	LAST	1290	27,2717	28636 0			ATOPCSM
1100					27,2720	52014 0		CLEAR	GOTO
1101	REP	13	LAST	1296	27,2721	01671 0			ORBWFLAG
1102	REP	1			27,2722	56725 1			INTWAKEX
1103					27,2723	77624 1	INTWAKLM	CALL	
1104	REP	3	LAST	1290	27,2724	28711 1			ATOPLEM
1105					27,2725	77814 1	INTWAKEX	CLEAR	
1106	REP	11	LAST	1296	27,2726	02876 1			RENDWFLG
1107					27,2727	45131 0	INTWAKUP	SSP	CALL
1108	REP	6	LAST	1301	27,2730	01502 1			UPSVFLAG
1109					27,2731	00000 1			0
1110	REP	2	LAST	635	27,2732	27404 1			INTWAKE0
1111					27,2733	77776 1		EXIT	
1112	REP	97	LAST	1294	27,2734	0 5301 0		TC	PHASCHNG
1113					27,2735	04026 1		OCT	04026
1114	REP	3	LAST	1300	27,2736	0 0330 1		TC	INTWAKUO
1115					27,2737	00002 0	UPMNSVCD	OCT	2
1116					27,2740	00000 1		OCT	0
1117					27,2741	77420 1	GRP2PC	STO	EXIT
1118	REP	3	LAST	120	27,2742	03536 1			GRP2SVO
1119	REP	96	LAST	1301	27,2743	0 5301 0		TC	PHASCHNG
1120					27,2744	04022 0		OCT	04022
1121	REP	236	LAST	1300	27,2745	0 8006 1		TC	INTPRET
1122					27,2746	77850 1		GOTO	
1123	REP	4	LAST	1301	27,2747	03536 1			GRP2SVO

LUNAR SPHERE OF INFLUENCE.

COMMON CODING AFTER X2 INITIALIZED AND
MOONFLAG SET(OR CLEARED).
IS THIS A REQUEST FOR A LEM OR CSM
 STATE VECTOR UPDATE......
UPDATE CSM STATE VECTOR

UPDATE   LM STATE VECTOR

REMOVE 'UPDATE STATE VECTOR INDICATOR'

RELEASE 'GRAB' OF ORBIT INTEG

R0001			DELETE							
0002				13,3715			BANK	13		
0003	REP	1		11,2000			SETLOC	ORBITAL		
0004				11,2310			BANK			
0005	REP	1		11,2310			COUNT	11/ORBIT		
R0006			DELETE							
0007				11,2310	40354 1	KEPPREP	LXA,2	SETPD		
0008	REP	10	LAST 1292	11,2311	02150 1			PBODY		
0009				11,2312	00001 0			0		
0010				11,2313	75543 1		DLOAD*	SQRT	SQRT(MU) (+18 OR +15) 0D	PL 2D
0011	REP	4	LAST 1292	11,2314	50041 1			MUEARTH,2		
0012				11,2315	53515 0		PDVL	UNIT		PL 8D
0013	REP	20	LAST 1300	11,2316	01535 0			RCV		
0014				11,2317	60325 0		PDDL	NORM	NORM R (+29 OR +27 - N1) 2D	PL 4D
0015				11,2320	00045 0			36D		
0016	REP	85	LAST 1288	11,2321	00047 1			X1		
0017				11,2322	77715 1		PDVL			
0018				11,2323	65241 0		DOT	PDDL	P*SQRT(MU)(+7 OR+5) 4D	PL 6D
0019	REP	15	LAST 1267	11,2324	01543 1			VCV		
0020	REP	8	LAST 1291	11,2325	02312 0			TAU.	(+28)	
0021				11,2326	60225 1		DSU	NORM		
0022	REP	9	LAST 1291	11,2327	01551 1			TC		
0023	REP	44	LAST 1228	11,2330	00051 0			S1		
0024				11,2331	77742 0		SR1			
0025				11,2332	65271 0		DDV	PDDL		
0026				11,2333	00003 0			2D		
0027				11,2334	41405 0		DMP	PUSH	PS(+6 +N1-N2) 6D	PL 8D
0028				11,2335	00005 1			4D		
0029				11,2336	65316 0		DSQ	PDDL	(PS)SQ(+12 +2(N1-N2)) 8D	PL 10D
0030				11,2337	00005 1			4D		
0031				11,2340	64716 0		DSQ	PDDL*	SSO/MU(-2OR +2(N1-N2)) 10D	PL 12D
0032	REP	5	LAST 1302	11,2341	50041 1			MUEARTH,2		
0033				11,2342	40442 1		SR3	SR4		
0034.				11,2343	47515 0		PDVL	VSQ	PREALIGN MU (+43 OR +37) 12D	PL 14D
0035	REP	16	LAST 1302	11,2344	01543 1			VCV		
0036				11,2345	44205 0		DMP	BDSU		PL 12D
0037				11,2346	00045 0			36D		
0038				11,2347	41271 0		DDV	DMP		PL 10D
0039				11,2350	00003 1			2D	-(1/R-ALPHA)(+12 +3N1-2N2)	
0040				11,2351	53605 1		DMP	SL*		
0041	REP	1		11,2352	23717 1			DP2/3		
0042				11,2353	20176 0			0 -3,1	10L(1/R-ALPHA)(+13 +2(N1-N2))	
0043				11,2354	43260 1		XSU,1	DAD	2(PS)SO - ETCETRA	PL 8D
0044	REP	45	LAST 1302	11,2355	00050 1			S1	X1 = N2-N1	
0045				11,2356	45257 0		SL*	DSU	-PS+2(PS)SO ETC (+6 +N1-N2)	PL 6D
0046				11,2357	20211 1			8D,1		
0047				11,2360	41205 0		DMP	DMP		
0048				11,2361	00001 0			0D		
0049				11,2362	00005 1			4D		
0050				11,2363	53657 0		SL*	SL*		

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0051					11,2364	20211 1		8D,1
0052					11,2365	20201 0		0,1
0053					11,2366	65215 1	DAD	PDDL
0054	REP	2	LAST	94	11,2367	01553 0		XKEP
0055					11,2370	53605 1	DMP	SL*
0056					11,2371	00001 0		0D
0057					11,2372	20202 0		1,1
0058					11,2373	43204 0	BOVB	DAD
0059	REP	10	LAST	1229	11,2374	57343 1		TCDANZIG
0060					11,2375	77628 0	STADR	
0061	REP	4	LAST	1251	11,2376	75471 1	STORE	XKEPNEW
0062					11,2377	74020 0	STQ	AxC,1
0063	REP	3	LAST	1253	11,2400	02270 0		KEPRTN
0064					11,2401	00012 1	DEC	10
0065					11,2402	74014 1	BON	AxC,1
0066	REP	21	LAST	1301	11,2403	00303 1		MOONFLAG
0067	REP	1			11,2404	24000 1		KEPLERN
0068					11,2405	00002 0	DEC	2
0069					11,2406	77850 1	GOTO	
0070	REP	2	LAST	1303	11,2407	24000 1		KEPLERN

S(-FS(1-2FS)-1/6...)(+17 OR +16)
                                      PL 8D

S(+17 OR +16)

0071					11,2410	66350 1	FBR3	LXA,1	SSP
0072	REP	18	LAST	1288	11,2411	01500 0			DIPEQCNT
0073	REP	46	LAST	1302	11,2412	00051 0			S1
0074					11,2413	77782 1		DEC	-13
0075					11,2414	54345 1		DLOAD	SR
0076	REP	9	LAST	1293	11,2415	02314 0			DT/2
0077					11,2416	20812 0			9D
0078					11,2417	61500 0		TIX,1	ROUND
0079					11,2420	22421 0			+1
0080					11,2421	43208 1		PUSH	DAD
0081	REP	10	LAST	1302	11,2422	01551 1			TC
0082	REP	9	LAST	1302	11,2423	18312 0		STODL	TAU.
0083					11,2424	77815 0		DAD	
0084	REP	22	LAST	1299	11,2425	01517 0			TET
0085	REP	23	LAST	1304	11,2426	35517 1		STCALL	TET
0086	REP	2	LAST	1291	11,2427	22310 0			KEPPREP

P0087							AGC ROUTINE TO COMPUTE ACCELERATION COMPONENTS.	
0088					11,2430	73150 1	ACCOMP	LXA,1	LXA,2
0089	REF	11	LAST	1302	11,2431	02150 1		PBODY
0090	REF	12	LAST	1305	11,2432	02150 1		PBODY
0091	.				11,2433	77775 1	VLOAD	
0092	REF	10	LAST	1289	11,2434	11458 0		ZEROVEC
0093	REF	2	LAST	87	11,2435	26202 0	STOVL	PV
0094	REF	32	LAST	1209	11,2436	02152 0		ALPHAV
0095					11,2437	53257 1	VSL*	VAD
0096					11,2440	57605 0		0 -7,2
0097	REF	21	LAST	1302	11,2441	01535 0		RCV
0098	REF	2	LAST	67	11,2442	02160 1	STORE	BETAV
0099					11,2443	65014 1	BOF	XCHX,2
0100	REF	17	LAST	1299	11,2444	01756 1		DIM0FLAG
0101					11,2445	22452 1		+5
0102	REF	19	LAST	1304	11,2446	01500 0		DIFEQCNT
0103	REF	7	LAST	87	11,2447	12217 0	STORE	VECTAB,2
0104					11,2450	77724 0	XCHX,2	
0105	REF	20	LAST	1305	11,2451	01500 0		DIFEQCNT
0106					11,2452	53575 0	VLOAD	UNIT
0107	REF	33	LAST	1305	11,2453	02152 0		ALPHAV
0108	REF	34	LAST	1305	11,2454	16152 0	STODL	ALPHAV
0109					11,2455	00045 0		36D
0110	REF	4	LAST	1207	11,2456	02310 1	STORE	ALPHAM
0111					11,2457	77624 1	CALL	
0112	REF	1			11,2460	22562 0		GAMCOMP
0113					11,2461	66175 0	VLOAD	SXA,1
0114	REF	3	LAST	1305	11,2462	02160 1		BETAV
0115	REF	33	LAST	1286	11,2463	00051 0		S2
0116	REF	35	LAST	1305	11,2464	16152 0	STODL	ALPHAV
0117	REF	2	LAST	67	11,2465	02210 0		BETAM
0118	REF	5	LAST	1305	11,2466	02310 1	STORE	ALPHAM
0119					11,2467	71214 0	BOF	DLOAD
0120	REF	3	LAST	1292	11,2470	00342 1		MIDFLAG
0121	REF	1			11,2471	22725 1		OBLATE
0122	REF	24	LAST	1304	11,2472	01517 0		TET
0123					11,2473	77624 1	CALL	
0124	REF	2	LAST	704	11,2474	54110 0		LSPOS
0125					11,2475	72174 0	AXT,2	LXA,1
0126					11,2476	00002 0		2
0127	REF	34	LAST	1305	11,2477	00051 0		S2
0128					11,2500	77614 1	BOF	
0129	REF	22	LAST	1303	11,2501	00343 0		MOONFLAG
0130					11,2502	22505 1		+3
0131					11,2503	77076 0	VCOMP	AXT,2
0132					11,2504	00000 1		0
0133	REF	4	LAST	1305	11,2505	02160 1	STORE	BETAV
0134	REF	3	LAST	67	11,2506	26263 1	STOVL	RPOV

0135					11,2507	00003 1			2D
0136	REF	2	LAST	87	11,2510	02300 0		STORE	RPSV
0137					11,2511	45335 0		SLOAD	DSU
0138	REF	14	LAST	1293	11,2512	01012 0			MODREG
0139	REF	1			11,2513	23721 1			OCT27
0140					11,2514	43030 0		BHIZ	BOF
0141					11,2515	22520 0			+3
0142	REF	18	LAST	1305	11,2516	01758 1			DIMoFLAG
0143	REF	1			11,2517	22534 0			GETRPSV
0144					11,2520	74375 0		VLOAD	VXSC
0145	REF	38	LAST	1305	11,2521	02152 0			ALPHAV
0146	REF	6	LAST	1305	11,2522	02310 1			ALPHAM
0147					11,2523	52257 0		VSR*	VSU
0148					11,2524	57175 0			1,2
0149	REF	5	LAST	1305	11,2525	02160 1			BETAV
0150					11,2526	77724 0		XCHX,2	
0151	REF	21	LAST	1305	11,2527	01500 0			DIFEQCNT
0152	REF	8	LAST	1305	11,2530	12225 1		STORE	VECTAB +6,2
0154	REF	5	LAST	614	11,2531	02272 0		STORE	ROVV
0155					11,2532	77724 0		XCHX,2	
0156	REF	22	LAST	1306	11,2533	01500 0			DIFEQCNT
0157					11,2534	62175 0	GETRPSV	VLOAD	INCR,1
0158	REF	4	LAST	1305	11,2535	02283 1			RPOV
0159					11,2536	00004 0			4
0160					11,2537	43014 0		CLEAR	BOF
0161	REF	3	LAST	1290	11,2540	04260 1			RPQFLAG
0162	REF	23	LAST	1305	11,2541	00343 0			MOONFLAG
0163					11,2542	22547 1			+5
0164					11,2543	53261 1		VSR	VAD
0165					11,2544	20612 0			9D
0166	REF	3	LAST	1306	11,2545	02300 0			RPSV
0167	REF	4	LAST	1306	11,2546	02300 0		STORE	RPSV
0168					11,2547	77624 1		CALL	
0169	REF	2	LAST	1305	11,2550	22562 0			GAMCOMP
0170					11,2551	62174 1		AXT,2	INCR,1
0171					11,2552	00004 0			4
0172					11,2553	00004 0			4
0173					11,2554	77775 1		VLOAD	
0174	REF	5	LAST	1306	11,2555	02300 0			RPSV
0175	REF	6	LAST	1306	11,2556	36160 0		STCALL	BETAV
0176	REF	3	LAST	1306	11,2557	22562 0			GAMCOMP
0177					11,2560	77850 1		GOTO	
0178	REF	2	LAST	1305	11,2561	22725 1			OBLATE
0179					11,2562	74575 0	GAMCOMP	VLOAD	VSR1
0180	REF	7	LAST	1306	11,2563	02160 1			BETAV
0181					11,2564	40236 1		VSQ	SETPD
0182					11,2585	00001 0			0
0183					11,2566	61501 1		NORM	ROUND
0184					11,2567	00040 0			31D
0185					11,2570	60325 0		PDDL	NORM NORMED B SQUARED TO PD LIST

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Line	REP	LAST	Address	Octal		Label	Operand	Comment
0186	REP 7	LAST 1306	11,2571	02310	1		ALPHAM	NORMALIZE (LESS ONE) LENGTH OF ALPHA
0187			11,2572	00041	1		32D	SAVING NORM SCALE FACTOR IN X1
0188			11,2573	63342	1	SR1	PDVL	
0189	REP 8	LAST 1306	11,2574	02160	1		BETAV	C(PDL+2) = ALMOST NORMED ALPHA
0190			11,2575	77656	1	UNIT		
0191	REP 9	LAST 1307	11,2576	16160	1	STODL	BETAV	
0192			11,2577	00045	0		36D	
0193	REP 3	LAST 1305	11,2600	02210	0	STORE	BETAM	
0194			11,2601	55301	0	NORM	BDDV	FORM NORMALIZED QUOTIENT ALPHAM/BETAM
0195			11,2602	00042	1		33D	
0196			11,2603	41562	0	SR1R	PUSH	C(PDL+2) = ALMOST NORMALIZED RHO.
0197			11,2604	77743	1	DLOAD*		
0198	REP 1		11,2605	27730	0		ASCALE,1	
0199	REP 47	LAST 1304	11,2606	00051	0	STORE	S1	
0200			11,2607	57124	1	XCHX,2	XAD,2	
0201	REP 48	LAST 1307	11,2610	00050	1		S1	
0202			11,2611	00040	0		32D	
0203			11,2612	71284	1	XSU,2	DLOAD	
0204			11,2613	00041	1		33D	
0205			11,2614	00003	1		2D	
0206			11,2615	65057	0	SR*	XCHX,2	
0207			11,2616	57177	1		0 -1,2	
0208	REP 49	LAST 1307	11,2617	00050	1		S1	
0209			11,2620	74406	0	PUSH	SR1R	RHO/4 TO 4D
0210			11,2621	50315	0	PDVL	DOT	
0211	REP 37	LAST 1306	11,2622	02152	0		ALPHAV	
0212	REP 10	LAST 1307	11,2623	02160	1		BETAV	
0213			11,2624	44372	1	SL1R	BDSU	(RHO/4) - 2(ALPHAV/2.BETAV/2)
0214			11,2625	57206	1	PUSH	DMPR	TO PDL+6
0215			11,2626	00005	1		4	
02155			11,2627	77752	1	SL1		
0216			11,2630	43206	1	PUSH	DAD	
0217	REP 1		11,2631	23701	0		DQUARTER	
0218			11,2632	75406	1	PUSH	SQRT	
0219			11,2633	41475	1	DMPR	PUSH	
0220			11,2634	00013	0		10D	
0221			11,2635	43352	1	SL1	DAD	
0222	REP 2	LAST 1307	11,2636	23701	0		DQUARTER	
0223			11,2637	43325	1	PDDL	DAD	(1/4)+2((Q+1)/4) TO PD+14D
0224			11,2640	00013	0		10D	
0225	REP 1		11,2641	11454	1		HALFDP	
0226			11,2642	72475	1	DMPR	SL1	
0227			11,2643	00011	1		8D	
0228			11,2644	56215	1	DAD	DDV	
0229	REP 1		11,2645	23673	1		THREE/8	
0230			11,2646	00017	1		14D	
0231			11,2647	74275	1	DMPR	VXSC	
0232			11,2650	00007	0		6	
0233	REP 11	LAST 1307	11,2651	02160	1		BETAV	
0234			11,2652	64515	1	PDVL	VSR3	(G/2)(C(PD+4))B/2 TO PD+16D

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0235	REP	36	LAST 1307	11,2653	02152 0			ALPHAV	
0236				11,2654	41455 0		VAD	PUSH	A_{12} + C(PD+16D) TO PD+16D
0237				11,2655	41345 0		DLOAD	DMP	
0238				11,2656	00001 0			0	
0239				11,2657	00015 0			12D	
0240				11,2660	61501 1		NORM	ROUND	
0241				11,2661	00037 0			30D	
0242				11,2662	40665 0		BDDV	DMP*	
0243				11,2663	00003 1			2	
0244	REP	6	LAST 1302	11,2664	50041 1			MUEARTH,2	
0245				11,2665	74276 1		DCOMP	VXSC	
0246				11,2666	57124 1		XCHX,2	XAD,2	
0247	REP	50	LAST 1307	11,2667	00050 1			S1	
0248	REP	35	LAST 1305	11,2670	00051 0			S2	
0249				11,2671	55064 0		XSU,2	XSU,2	
0250				11,2672	00036 1			30D	
0251				11,2673	00037 0			31D	
02513				11,2674	77600 1		BOV		CLEAR OVIND
02516				11,2675	22676 0			+1	
0252				11,2676	65057 0		VSR*	XCHX,2	
0253				11,2677	57177 1			0 -1,2	
0254	REP	51	LAST 1308	11,2700	00050 1			S1	
0255				11,2701	77655 1		VAD		
0256	REP	3	LAST 1305	11,2702	02202 0			PV	
0257	REP	4	LAST 1306	11,2703	02202 0		STORE	PV	
025805				11,2704	43400 1		BOV	RVO	RETURN IF NO OVERFLOW
02581				11,2705	22706 0			+1	
025815				11,2706	54345 1	GORAQUE	DLOAD	SR	
02582	REP	2	LAST 87	11,2707	02212 1			H	
025825				11,2710	20612 0			9D	
02583				11,2711	44206 0		PUSH	BDSU	
025835	REP	11	LAST 1304	11,2712	01551 1			TC	
02584	REP	10	LAST 1304	11,2713	16312 0		STODL	TAU.	
025845	REP	25	LAST 1305	11,2714	01517 0			TET	
02585				11,2715	45425 0		DSU	STADR	
025855	REP	26	LAST 1306	11,2716	42260 0		STCALL	TET	
02586	REP	3	LAST 1304	11,2717	22310 0			KEPPREP	
025865				11,2720	77624 1		CALL		
02587	REP	6	LAST 1300	11,2721	23344 0			RECTIFY	
025875				11,2722	77614 1		SETGO		
02588	REP	4	LAST 1306	11,2723	04020 1			RPOFLAG	
025885	REP	4	LAST 1299	11,2724	27234 1			TESTLOOP	

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P0259   THE OBLATE ROUTINE COMPUTES THE ACCELERATION DUE TO OBLATENESS. IT USES THE UNIT OF THE VEHICLE
R0261   POSITION VECTOR FOUND IN ALPHAV AND THE DISTANCE TO THE CENTER IN ALPHAM. THIS IS ADDED TO THE SUM OF THE
R0263   DISTURBING ACCELERATIONS IN FV AND THE PROPER DIFEQ STAGE IS CALLED VIA X1.

0265				11,2725	71354 0	OBLATE	LXA,2	DLOAD	
0266	REF	13	LAST 1305	11,2726	02150 1			PBODY	
0267	REF	8	LAST 1307	11,2727	02310 1			ALPHAM	
0268				11,2730	44601 0		SETPD	DSU*	
0269				11,2731	00001 0			0	
0270	REF	1		11,2732	50007 0			RDE,2	
0271				11,2733	43044 0		BPL	BOF	GET URPV
0272	REF	1		11,2734	23135 1			NBRANCH	
0273	REF	24	LAST 1306	11,2735	00343 0			MOONFLAG	
0274	REF	1		11,2736	23144 1			COSPHIE	
0275				11,2737	65375 0		VLOAD	PDDL	
0276	REF	39	LAST 1306	11,2740	02152 0			ALPHAV	
0277	REF	27	LAST 1306	11,2741	01517 0			TBT	
0276				11,2742	45125 0		PDDL	CALL	
0279	REF	1		11,2743	23671 0			3/5	
0260	REF	4	LAST 1206	11,2744	55366 1			R-TO-RP	
0264	REF	1		11,2745	00017 1		STORE	URPV	
0265				11,2746	47375 0		VLOAD	VXV	
0266	REF	3	LAST 1215	11,2747	02012 0			504LM	
0287	REF	3	LAST 1267	11,2750	11450 0			ZINIT	
0266				11,2751	61255 1		VAD	VXM	
0289	REF	4	LAST 1309	11,2752	11450 0			ZINIT	
0290	REF	6	LAST 1218	11,2753	00025 0			MMATRIX	
0291	.			11,2754	77656 1		UNIT		POSSIBLY UNNECESSARY
0292	REF	1		11,2755	00025 0	COMTERM	STORE	UZ	
0293				11,2756	57345 1		DLOAD	DMPR	
0294	REF	1		11,2757	00023 0			COSPHI/2	
0295	REF	1		11,2760	23703 1			3/32	
0296				11,2761	63525 0		PDDL	DSQ	P2/64 TO PD0
0297	REF	2	LAST 1309	11,2762	00023 0			COSPHI/2	
0296				11,2763	45275 0		DMPR	DSU	
0299	REF	1		11,2764	23705 1			15/16	
0300	REF	1		11,2765	23677 0			3/64	
0301				11,2766	57206 1		PUSH	DMPR	P3/32 TO PD2
0302	REF	3	LAST 1309	11,2767	00023 0			COSPHI/2	
0303				11,2770	76405 1		DMP	SL1R	
0304	REF	1		11,2771	23711 1			7/12	
0305				11,2772	57325 1		PDDL	DMPR	
0306				11,2773	00001 0			0	
0307	REF	1		11,2774	23717 1			2/3	
0308				11,2775	41421 0		BDSU	PUSH	P4/128 TO PD4
0309				11,2776	57275 0		DMPR	DMPR	
0310	REF	4	LAST 1309	11,2777	00023 0			COSPHI/2	BEGIN COMPUTING P5/1024
0311	REF	1		11,3000	23713 0			9/16	
0312				11,3001	57325 1		PDDL	DMPR	
0313				11,3002	00003 1			2	
0314	REF	1		11,3003	23715 0			5/128	

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Line	REF		LAST	Address	Code		Opcode	Operand	Comments
0315				11,3004	77621	1	BDSU		
0316				11,3005	77603	1	DMP*		
0317	REF	1		11,3006	50035	1		J4REQ/J3,2	
0318				11,3007	43271	1	DDV	DAD	-3
0319	REF	9	LAST 1309	11,3010	02310	1		ALPHAM	$(((P_5/256)B 2 /R+P_4/32) /R+P_3/8)ALPHAV$
0320				11,3011	00005	1		4	
0321				11,3012	56273	1	DMPR*	DDV	
0322	REF	1		11,3013	50031	0		2J3RE/J2,2	
0323	REF	10	LAST 1310	11,3014	02310	1		ALPHAM	
0324				11,3015	74215	1	DAD	VXSC	
0325				11,3016	00003	1		2	
0326	REF	40	LAST 1309	11,3017	02152	0		ALPHAV	
0327	REF	1		11,3020	14033	1	STODL	TVEC	
0328				11,3021	70403	1	DMP*	SR1	
0329	REF	2	LAST 1310	11,3022	50035	1		J4REQ/J3,2	
0330				11,3023	43271	1	DDV	DAD	
0331	REF	11	LAST 1310	11,3024	02310	1		ALPHAM	-3
0332				11,3025	50473	1	DMPR*	SR3	
0333	REF	2	LAST 1310	11,3026	50031	0	DDV	2J3RE/J2,2	3 4
0334				11,3027	43271	1	DDV	DAD	
0335	REF	12	LAST 1310	11,3030	02310	1		ALPHAM	
0336				11,3031	76561	1	VXSC	VSL1	
0337	REF	2	LAST 1309	11,3032	00025	0		UZ	
0338				11,3033	77645	0	BVSU		
0339	REF	2	LAST 1310	11,3034	00033	1		TVEC	
0340	REF	3	LAST 1310	11,3035	14033	1	STODL	TVEC	
0341	REF	13	LAST 1310	11,3036	02310	1		ALPHAM	
0342				11,3037	63501	0	NORM	DSQ	
0343	REF	86	LAST 1302	11,3040	00047	1		X1	
0344				11,3041	60316	0	DSQ	NORM	
0345	REF	52	LAST 1306	11,3042	00051	0		S1	4
0346				11,3043	54606	0	PUSH	BDDV*	NORMED R TO 0D
0347	REF	1		11,3044	50025	0		J2REOSQ,2	
0348				11,3045	77761	1	VXSC		
0349	REF	4	LAST 1310	11,3046	00033	1		TVEC	
0350	REF	5	LAST 1310	11,3047	00033	1	STORE	TVEC	
0351				11,3050	56070	0	XAD,1	XAD,1	
0352	REF	67	LAST 1310	11,3051	00046	0		X1	
0353	REF	66	LAST 1310	11,3052	00046	0		X1	
0354				11,3053	43070	1	XAD,1	BOF	
0355	REF	53	LAST 1310	11,3054	00050	1		S1	
0356	REF	25	LAST 1309	11,3055	00343	0		MOONFLAG	
0357	REF	1		11,3056	23125	0		NBRANCH1	
0358				11,3057	63545	0	DLOAD	DSQ	
0359	REF	2	LAST 1309	11,3060	00017	1		URPV	$X^2 B-2 TO 2D$
0360				11,3061	63525	0	PDDL	DSQ	
0361	REF	3	LAST 1310	11,3062	00021	1		URPV +2	$Y^2 +X^2 B-2 TO 2D$
0362				11,3063	65215	1	DAD	PDDL	
0363				11,3064	00003	1		2D	
0364				11,3065	45352	1	SL1	DSU	

L   ORBITAL INTEGRATION

Seq	REF	Address	Octal	Label	Op	Operand	Comment
0365		11,3066	00003 1			2D	X -Y B-2 TO 4D COSPHI 2 TO 6D
0366		11,3067	41525 0		PDDL	PUSH	
0367	REP 5 LAST 1309	11,3070	00023 0			COSPHI/2	2COSPHI(UZ) B-3 TO 6D
0368		11,3071	65381 0		VXSC	PDDL	
0369	REP 3 LAST 1310	11,3072	00025 0			UZ	
0370		11,3073	45316 1		DSQ	DSU	
0371	REP 2 LAST 1309	11,3074	23671 0			3/5	$(X -Y)((5COS (PHI)-3)UR\ 2COS(PHI)UZ)$
0372		11,3075	52405 1		DMP	SL3	
0373	REP 3 LAST 1287	11,3076	27756 0			5/8	B-3 TO 4D
0374		11,3077	52361 1		VXSC	VSU	
0375	REP 41 LAST 1310	11,3100	02152 0			ALPHAV	
0376		11,3101	72561 0		VXSC	VSL2	
0377		11,3102	77725 1		PDDL		
0378	REP 4 LAST 1310	11,3103	00017 1			URPV	
0379		11,3104	63205 0		DMP	PDVL	XY B-2 TO 10D
0380	REP 5 LAST 1311	11,3105	00021 1			URPV +2	
0381	REP 42 LAST 1311	11,3106	02152 0			ALPHAV	
0382		11,3107	74235 0		VXV	VXSC	
0383	REP 4 LAST 1311	11,3110	00025 0			UZ	
0384		11,3111	53332 0		VSL3	VAD	4XY(UR X UZ) + D(4D) B-3
0385		11,3112	77725 1		PDDL		
0386		11,3113	41301 0		NORM	DMP	
03861	REP 36 LAST 1256	11,3114	00050 1			X2	$3J22R2MU/(X +Y)R$
0387		11,3115	00001 1			0D	
03871		11,3116	74265 0		BDDV	VXSC	
0388	REP 1	11,3117	27754 1			3J22R2MU	
0389		11,3120	53257 1		VSL*	VAD	
0390		11,3121	57605 0			0 -7,2	
0391	REP 6 LAST 1310	11,3122	00033 1			TVEC	
03911		11,3123	77754 1		LXA,2		
03912	REP 14 LAST 1309	11,3124	02150 1			PBODY	
03913		11,3125	77600 1	NBRANCH1	BOV		
03916		11,3126	23127 1			+1	
0392		11,3127	53257 1		VSL*	VAD	
0393		11,3130	20153 1			0 -22D,1	
0394	REP 5 LAST 1308	11,3131	02202 0			PV	
0395	REP 6 LAST 1311	11,3132	02202 0		STORE	PV	
03953		11,3133	77600 1		BOV		
03956	REP 1	11,3134	22706 0			GOBAQUE	
0396		11,3135	72135 0	NBRANCH	SLOAD	LXA,1	
0397	REP 23 LAST 1306	11,3136	01501 1			DIFEQCNT	MPAC
0398	REP 657 LAST 1299	11,3137	00154 1			MPAC	
0399		11,3140	73205 1		DMP	CGOTO	
0400	REP 1	11,3141	27760 0			-1/12	MPAC
0401	REP 658 LAST 1311	11,3142	00155 0			MPAC	DIFEQTAB
0402	REP 1	11,3143	23152 0	COSPHIE	DLOAD		
0403		11,3144	77745 1			ALPHAV +4	
0404	REP 43 LAST 1311	11,3145	02156 1		STOVL	COSPHI/2	
0405	REP 8 LAST 1311	11,3146	24023 0			ZUNIT	
0406	REP 5 LAST 1309	11,3147	11450 0				

0407				11,3150	77850 1		GOTO	
0408	REP	1		11,3151	22755 0			COMTERM
0409	REP	1		11,3152	23371 0	DIFEQTAB CADR		DIFEQ+0
0410	REP	1		11,3153	23375 1		CADR	DIFEQ+1
0411	REP	1		11,3154	23408 1		CADR	DIFEQ+2
0412				11,3155	77214 0	TIMESTEP BOF		VLOAD
0413	REP	4	LAST 1305	11,3156	00342 1			MIDFLAG
0414	REP	1		11,3157	23206 1			RECTEST
0415	REP	22	LAST 1305	11,3160	01535 0			RCV
0416				11,3161	41241 0		DOT	DMP
04162	REP	17	LAST 1302	11,3162	01543 1			VCV
04163	REP	10	LAST 1304	11,3163	02314 0		DT/2	
04164				11,3164	77640 0		BMN	
04166	REP	2	LAST 1312	11,3165	23208 1			RECTEST
0417				11,3166	43014 0		BON	BOF
0418	REP	26	LAST 1310	11,3167	00303 1			MOONFLAG
0419	REP	1		11,3170	23263 1			LUNSPH
0420	REP	5	LAST 1308	11,3171	04340 1			RPQFLAG
0421	REP	1		11,3172	23260 1			EARSPH
0422				11,3173	45145 0		DLOAD	CALL
0423	REP	28	LAST 1309	11,3174	01517 0			TET
0424	REP	3	LAST 1305	11,3175	54110 0			LSPOS
0425	REP	5	LAST 1306	11,3176	02263 1		STORE	RPQV
04253				11,3177	77754 1		LXA,2	
04256	REP	15	LAST 1311	11,3200	02150 1			PBODY
0426				11,3201	51445 0	INLUNCHK BVSU		ABVAL
0427	REP	23	LAST 1312	11,3202	01535 0			RCV
0428				11,3203	50025 0		DSU	BMN
0429	REP	1		11,3204	27784 1			RSPHERE
0430	REP	1		11,3205	23300 0			DOSWITCH
0434				11,3206	51575 1	RECTEST VLOAD		ABVAL
04345	REP	6	LAST 1289	11,3207	01521 0			TDELTAV
04346				11,3210	77800 1		BOV	
04347	REP	1		11,3211	23234 0			CALLRECT
0435				11,3212	51025 1		DSU	BPL
04355	REP	2	LAST 32	11,3213	23707 0			3/4
0436	REP	2	LAST 1312	11,3214	23234 0			CALLRECT
04385				11,3215	53615 0		DAD	SL*
0437	REP	3	LAST 1312	11,3216	23707 0			3/4
04375				11,3217	57605 0			0 -7,2
0438				11,3220	45271 1		DDV	DSU
04385				11,3221	00013 0			10D
0439	REP	1		11,3222	27762 1			RECRATIO
04395				11,3223	77244 0		BPL	VLOAD
0440	REP	3	LAST 1312	11,3224	23234 0			CALLRECT
0441	REP	8	LAST 1289	11,3225	01527 0			TNUV
0442				11,3226	45246 0		ABVAL	DSU
0443	REP	4	LAST 1312	11,3227	23707 0			3/4
04431				11,3230	77600 1		BOV	
04432	REP	4	LAST 1312	11,3231	23234 0			CALLRECT

(R.V) X (DELTA T)

RPQV IN MPAC
RPQV

RECTIFY IF

1) EITHER TDELTAV OR TNUV EQUALS OR
   EXCEEDS 3/4 IN MAGNITUDE

            OR

2) ABVAL(TDELTAV) EQUALS OR EXCEEDS
   .01(ABVAL(RCV))

0444				11,3232	77640 0		BMN	
0445	REP	1		11,3233	23238 1			INTGRATE
04453				11,3234	77624 1	CALLRECT	CALL	
04456	REP	7	LAST 1308	11,3235	23344 0			RECTIFY
0446				11,3236	77775 1	INTGRATE	VLOAD	
0447	REP	9	LAST 1312	11,3237	01527 0			TNUV
0448	REP	1		11,3240	25120 0		STOVL	ZV
0449	REP	9	LAST 1312	11,3241	01521 0			TDELTAV
0450	REP	2	LAST 76	11,3242	01112 1		STORE	YV
0451				11,3243	77614 1		CLEAR	
0452	REP	1		11,3244	00261 1			JSWITCH
0453				11,3245	66375 0	DIFEQ0	VLOAD	SSP
0454	REP	3	LAST 1313	11,3246	01112 1			YV
0455	REP	24	LAST 1311	11,3247	01501 1			DIFEQCNT
0456				11,3250	00000 1			0
0457	REP	44	LAST 1311	11,3251	16152 0		STODL	ALPHAV
0458	REP	3	LAST 1210	11,3252	11458 0			DPZERO
0459	REP	3	LAST 1308	11,3253	02212 1		STORE	H
0460				11,3254	52014 0		BON	GOTO
0461	REP	2	LAST 1313	11,3255	00301 0			JSWITCH
0462	REP	1		11,3256	23810 1			DOW..
0463	REP	1		11,3257	22430 0			ACCOMP
0464				11,3260	52175 0	EARSPH	VLOAD	GOTO
04641	REP	6	LAST 1312	11,3261	02263 1			RPOV
04642	REP	1		11,3262	23201 0			INLUNCHK
04643				11,3263	60545 0	LUNSPH	DLOAD	SR2
04644				11,3264	00013 0			10D
04645				11,3265	50025 0		DSU	BMN
04646	REP	2	LAST 1312	11,3266	27764 1			RSPHERE
04647	REP	3	LAST 1312	11,3267	23206 1			RECTEST
04648				11,3270	71214 0		BOP	DLOAD
04649	REP	6	LAST 1312	11,3271	04340 1			RPOFLAG
0465	REP	2	LAST 1312	11,3272	23300 0			DOSWITCH
04651	REP	29	LAST 1312	11,3273	01517 0			TET
04652				11,3274	77624 1		CALL	
0466	REP	2	LAST 667	11,3275	54115 0			LUNPOS
0467				11,3276	77676 0		VCOMP	
0468	REP	7	LAST 1313	11,3277	02263 1		STORE	RPOV
0469				11,3300	77624 1	DOSWITCH	CALL	
0470	REP	1		11,3301	23304 1			ORIGCHNG
0471				11,3302	77650 1		GOTO	
0472	REP	2	LAST 1313	11,3303	23238 1			INTGRATE
0473				11,3304	45020 1	ORIGCHNG	STQ	CALL
0474	REP	3	LAST 87	11,3305	02270 0			ORIGEX
0475	REP	6	LAST 1313	11,3306	23344 0			RECTIFY
0476				11,3307	53775 1		VLOAD	VSL*
0477	REP	24	LAST 1312	11,3310	01535 0			RCV
0478				11,3311	57576 1			0,2
0479				11,3312	53651 0		VSU	VSL*
0480	REP	8	LAST 1313	11,3313	02263 1			RPOV

START H AT ZERO. GOES 0(DELT/2)DELT.

L   ORBITAL INTEGRATION

0481				11,3314	57574 0			2,2
0482	REF	13	LAST 1300	11,3315	01503 0	STORE		RRECT
0483	REF	25	LAST 1313	11,3316	15535 0	STODL		RCV
0484	REF	30	LAST 1313	11,3317	01517 0			TET
0485				11,3320	77624 1	CALL		
0486	REF	1		11,3321	54120 0			LUNVEL
0487				11,3322	57414 1	BOF		VCOMP
0488	REF	27	LAST 1312	11,3323	00343 0			MOONFLAG
0489				11,3324	23325 1			+1
0490				11,3325	53715 1	PDVL		VSL*
0491	REF	18	LAST 1312	11,3326	01543 1			VCV
0492				11,3327	57576 1			0,2
0493				11,3330	77651 0	VSU		
0494				11,3331	77657 0	VSL*		
0495				11,3332	57574 0			0 +2,2
0496	REF	9	LAST 1300	11,3333	01511 0	STORE		VRECT
0497	REF	19	LAST 1314	11,3334	01543 1	STORE		VCV
0498				11,3335	67154 0	LXA,2		SXA,2
0499	REF	4	LAST 1313	11,3336	02270 0			ORIGEX
0500	REF	26	LAST 1294	11,3337	00052 0			QPRET
0501				11,3340	52014 0	BON		GOTO
0502	REF	28	LAST 1314	11,3341	00303 1			MOONFLAG
0503	REF	2	LAST 1286	11,3342	26666 0			CLRMOON
0504	REF	3	LAST 1286	11,3343	26673 1			SETMOON

P0505   THE RECTIFY SUBROUTINE IS CALLED BY THE INTEGRATION PROGRAM AND OCCASIONALLY BY THE MEASUREMENT INCORPORATION
R0507   ROUTINES TO ESTABLISH A NEW CONIC.

0506					11,3344	77354 0	RECTIFY	LXA,2	VLOAD
0509	REF	16	LAST	1312	11,3345	02150 1			PBODY
0510	REF	10	LAST	1313	11,3346	01521 0			TDELTAV
0511					11,3347	53257 1		VSL*	VAD
0512					11,3350	57605 0			0 -7,2
0513	REF	26	LAST	1314	11,3351	01535 0			RCV
0514	REF	14	LAST	1314	11,3352	01503 0		STORE	RRECT
0515	REF	27	LAST	1315	11,3353	25535 0		STOVL	RCV
0516	REF	10	LAST	1313	11,3354	01527 0			TNUV
0517					11,3355	53257 1		VSL*	VAD
0518					11,3356	57602 1			0 -4,2
0519	REF	20	LAST	1314	11,3357	01543 0			VCV
0520	REF	10	LAST	1314	11,3360	01511 0	MINIRECT	STORE	VRECT
0521	REF	21	LAST	1315	11,3361	25543 1		STOVL	VCV
0522	REF	11	LAST	1305	11,3362	11456 0			ZEROVEC
0523	REF	11	LAST	1315	11,3363	01521 0		STORE	TDELTAV
0524	REF	11	LAST	1315	11,3364	15527 0		STODL	TNUV
0525	REF	12	LAST	1315	11,3365	11456 0			ZEROVEC
0526	REF	12	LAST	1308	11,3366	01551 1		STORE	TC
0527	REF	3	LAST	1303	11,3367	01553 0		STORE	XKEP
0528					11,3370	77616 0		RVQ	

P0529   THE THREE DIFEQ ROUTINES - DIFEQ+0, DIFEQ+12, AND DIFEQ+24 - ARE ENTEREDTO PROCESS THE CONTRIBUTIONS AT THE
R0531   BEGINNING, MIDDLE, AND END OF THE TIMESTEP, RESPECTIVELY. THE UPDATING IS DONE BY THE NYSTROM METHOD.

0533					11,3371	64575 1	DIFEQ+0	VLOAD	VSR3
0534	REP	7	LAST	1311	11,3372	02202 0			PV
0535	REP	2	LAST	67	11,3373	36166 0		STCALL	PHIV
0536	REP	1			11,3374	23551 1			DIFEQCOM
0537					11,3375	74575 0	DIFEQ+1	VLOAD	VSR1
0538	REP	8	LAST	1316	11,3376	02202 0			PV
0539					11,3377	53206 0		PUSH	VAD
0540	REP	3	LAST	1316	11,3400	02166 1			PHIV
0541	REP	2	LAST	67	11,3401	26174 1		STOVL	PSIV
0542					11,3402	53362 0		VSR1	VAD
0543	REP	4	LAST	1316	11,3403	02166 1			PHIV
0544	REP	5	LAST	1316	11,3404	36166 0		STCALL	PHIV
0545	REP	2	LAST	1316	11,3405	23551 1			DIFEQCOM
0546					11,3406	57345 1	DIFEQ+2	DLOAD	DMPR
0547	REP	4	LAST	1313	11,3407	02212 1			H
0548	REP	2	LAST	1302	11,3410	23717 1			DP2/3
0549					11,3411	74206 0		PUSH	VXSC
0550	REP	6	LAST	1316	11,3412	02166 1			PHIV
0551					11,3413	53372 1		VSL1	VAD
0552	REP	2	LAST	1313	11,3414	01120 0			ZV
0553					11,3415	53361 0		VXSC	VAD
0554	REP	5	LAST	1316	11,3416	02212 1			H
0555	REP	4	LAST	1313	11,3417	01112 1			YV
0556	REP	5	LAST	1316	11,3420	25112 1		STOVL	YV
0557	REP	9	LAST	1316	11,3421	02202 0			PV
0558					11,3422	53322 1		VSR3	VAD
0559	REP	3	LAST	1316.	11,3423	02174 1			PSIV
0560					11,3424	76561 1		VXSC	VSL1
0561					11,3425	77655 1		VAD	
0562	REP	3	LAST	1316	11,3426	01120 0			ZV
0564	REP	4	LAST	1316	11,3427	01120 0		STORE	ZV
0565					11,3430	45014 0		BOFF	CALL
0566	REP	3	LAST	1313	11,3431	00341 1			JSWITCH
0567	REP	1			11,3432	23502 1			ENDSTATE
0568	REP	23	LAST	1290	11,3433	56741 0			GRP2PC
0569					11,3434	77354 0		LXA,2	VLOAD
0570	REP	2	LAST	76	11,3435	01102 0			COLREG
0571	REP	5	LAST	1316	11,3436	01120 0			ZV
0572					11,3437	77732 1		VSL3	
0573	REP	70	LAST	1228	11,3440	12467 1		STORE	W +54D,2
0574					11,3441	77775 1		VLOAD	
0575	REP	6	LAST	1316	11,3442	01112 1			YV
0576					11,3443	40132 0		VSL3	BOV
0577	REP	1			11,3444	23574 0			WMATEND
0578	REP	71	LAST	1316	11,3445	.12401 1		STORE	W,2
0579					11,3446	77624 1		CALL	
0580	REP	24	LAST	1316	11,3447	56741 0			GRP2PC

ADJUST W-POSITION FOR STORAGE

0581				11,3450	66354 0	LXA,2	SSP	
0582	REF	3	LAST 1316	11,3451	01102 0		COLREG	
0583	REF	36	LAST 1308	11,3452	00052 0		S2	
0584				11,3453	00000 1		0	
0585				11,3454	67114 1	INCR,2	SXA,2	
0586				11,3455	00006 1		6	
0587	REF	7	LAST 1316	11,3456	01111 1		YV	
0588				11,3457	45104 0	TIX,2	CALL	
0589	REF	1		11,3460	23545 1		RELOADSV	
0590	REF	25	LAST 1316	11,3461	56741 0		GRP2PC	
0591				11,3462	67154 0	LXA,2	SXA,2	
0592	REF	8	LAST 1317	11,3463	01111 1		YV	
0593	REF	4	LAST 1317	11,3464	01102 0		COLREG	
0594				11,3465	77624 1	NEXTCOL	CALL	
0595	REF	26	LAST 1317	11,3466	56741 0		GRP2PC	
0596				11,3467	76754 0	LXA,2	VLOAD*	
0597	REF	5	LAST 1317	11,3470	01102 0	.	COLREG	
0598	REF	72	LAST 1316	·11,3471	75376 1		W,2	
0599				11,3472	77722 0	VSR3		ADJUST W-POSITION FOR INTEGRATION
0600	REF	9	LAST 1317	11,3473	01112 1	STORE	YV	
0601				11,3474	76173 0	VLOAD*	AXT,1	
0602	REF	73	LAST 1317	11,3475	75310 1		W +54D,2	
0603				11,3476	00000 1		0	
0604				11,3477	77722 0	VSR3		ADJUST W-VELOCITY FOR INTEGRATION
0605	REF	6	LAST 1316	11,3500	35120 1	STCALL	ZV	
0606	REF	1		11,3501	23245 0		DIFEQ0	
0607				11,3502	77200 0	ENDSTATE	BOV	VLOAD
06071	REF	2	LAST 1311	11,3503	22706 0		GOBAQUE	
0608	REF	7	LAST 1317	11,3504	01120 0		ZV	
0609	REF	12	LAST 1315	11,3505	25527 0	STOVL	TNUV	
0610	REF	10	LAST 1317	11,3506	01112 1		YV	
0611	REF	12	LAST 1315	11,3507	01521 0	STORE	TDELTAV	
0612				11,3510	43014 0	BON	BOFF	
06121	REF	3	LAST 1299	11,3511	04715 0		MIDAVFLG	
06122	REF	1		11,3512	27653 1		CKMID2	CHECK FOR MID2 BEFORE GOING TO TIMEINC
0613	REF	19	LAST 1306	11,3513	01756 1		DIM0FLAG	
0614	REF	5	LAST 1306	11,3514	27234 1		TESTLOOP	
06141				11,3515	77776 1	EXIT		
0615	REF	99	LAST 1301	11,3516	0 5301 0	TC	PHASCHNG	
0616				11,3517	04022 0	OCT	04022	PHASE 1
0617	REF	50	LAST 1290	11,3520	0 5435 0	TC	UPFLAG	PHASE CHANGE HAS OCCURRED BETWEEN
0618	REF	4	LAST 1290	11,3521	00236 0	ADRES	REINTFLG	INTSTALL AND INTWAKE
0620	REF 239		LAST 1301	11,3522	0 6006 1	TC	INTPRET	
0621				11,3523	77731 1	SSP		
06215	REF	27	LAST 1314	11,3524	00053 1		QPRET	
0622	REF	1		11,3525	23532 1		AMOVED	
0623				11,3526	52014 0	BON	GOTO	
0624	REF	20	LAST 1297	11,3527	01714 1		VINTFLAG	

L   ORBITAL INTEGRATION

0625	REP	4	LAST 1301	11,3530	26836 0			ATOPCSM
0626	REP	4	LAST 1301	11,3531	28711 1			ATOPLEM
0627				11,3532	66214 0	AMOVED	SET	SSP
0628	REP	4	LAST 1316	11,3533	00081 0			JSWITCH
0629	REP	6	LAST 1317	11,3534	01103 1			COLREG
0630				11,3535	77741 0		DEC	-30
0631				11,3536	66214 0	BOFF		SSP
0632	REP	8	LAST 1297	11,3537	01755 1			D6OR9FLG
0633	REP	1		11,3540	23485 1			NEXTCOL
0634	REP	7	LAST 1318	11,3541	01103 1			COLREG
0635				11,3542	77717 0		DEC	-48
0636				11,3543	77650 1		GOTO	
0637	REP	2	LAST 1318	11,3544	23485 1			NEXTCOL
0638				11,3545	77745 1	RELOADSV	DLOAD	
0639	REP	9	LAST 1299	11,3546	01101 0			TDEC
0640	REP	55	LAST 1298	11,3547	34041 0		STCALL	TDEC$_1$
0641	REP	1		11,3550	27120 1			INTEGRV2
0642				11,3551	43345 1	DIFEQCOM	DLOAD	DAD
0643	REP	11	LAST 1312	11,3552	02314 0			DT/2
0644	REP	6	LAST 1316	11,3553	02212 1			H
0645				11,3554	68110 1		INCR,1	SXA,1
0646				11,3555	77763 0		DEC	-12
0647	REP	25	LAST 1313	11,3556	01500 0			DIFEQCNT
0648	REP	7	LAST 1318	11,3557	02212 1		STORE	H
0649				11,3560	74581 0		VXSC	VSR$_1$
0650	REP	10	LAST 1316	11,3561	02202 1			PV
0651				11,3562	74255 0		VAD	VXSC
0652	REP	8	LAST 1317	11,3563	01120 0			ZV
0653	REP	6	LAST 1318	11,3564	02212 1			H
0654				11,3565	77855 1		VAD	
0655	REP	11	LAST 1317	11,3566	01112 1			YV
0656	REP	45	LAST 1313	11,3567	02152 0		STORE	ALPHAV
0657				11,3570	52014 0		BON	GOTO
0658	REP	5	LAST 1318	11,3571	00301 0			JSWITCH
0659	REP	2	LAST 1313	11,3572	23610 1			DOW..
0660	REP	1		11,3573	22410 1			FBR3
0661				11,3574	43014 0	WMATEND	CLEAR	CLEAR
0662	REP	20	LAST 1317	11,3575	01676 1			DIM0FLAG
0663	REP	14	LAST 1301	11,3576	01671 0			ORBWFLAG
06631				11,3577	77814 1		CLEAR	
06632	REP	12	LAST 1301	11,3600	02678 1			RENDWFLG
0664				11,3601	77414 0		SET	EXIT
0665	REP	7	LAST 1292	11,3602	01472 1			STATEFLG
0666	REP	35	LAST 1300	11,3603	0 5537 0		TC	ALARM
0667				11,3604	00421 0		OCT	421
0668	REP	240	LAST 1317	11,3605	0 8006 1		TC	INTPRET

RELOAD TEMPORARY STATE VECTOR
FROM PERMANENT IN CASE OF

BY STARTING AT INTEGRV2.
INCREMENT H AND DIFEQCNT.

DIFEQCNT SET FOR NEXT ENTRY.

DONT INTEGRATE W THIS TIME
INVALIDATE W

PICK UP STATE VECTOR UPDATE

```
0669                      11,3606   77650 1         GOTO
0670   REP   6  LAST 1317  11,3607   27234 1              TESTLOOP        FINISH INTEGRATING STATE VECTOR
```

P0671   ORBITAL ROUTINE FOR EXTRAPOLATION OF THE W MATRIX. IT COMPUTES THE SECOND DERIVATIVE OF EACH COLUMN POSITION
R0673   VECTOR OF THE MATRIX AND CALLS THE NYSTROM INTEGRATION ROUTINES TO SOLVE THE DIFFERENTIAL EQUATIONS. THE PROGRAM
R0675   USES A TABLE OF VEHICLE POSITION VECTORS COMPUTED DURING THE INTEGRATION OF THE VEHICLES POSITION AND VELOCITY.

0677				11,3610	70754 0	DOW..	LXA,2 DLOAD*
0678	REF	17	LAST 1315	11,3611	02150 1		PBODY
0679	REF	7	LAST 1306	11,3612	50041 1		MUEARTH,2
0680	REF	4	LAST 1307	11,3613	36210 1		STCALL BETAM
0681	REF	1		11,3614	23636 0		DOW..1
0682	REF	11	LAST 1316	11,3615	02202 0		STORE PV
0683				11,3616	62014 0	BOF	INCR,1
0684	REF	5	LAST 1312	11,3617	00342 1		MIDFLAG
0685	REF	2	LAST 1309	11,3620	23135 1		NBRANCH
0686				11,3621	77771 0	DEC	-6
0687				11,3622	70744 1	LXC,2	DLOAD*
0688	REF	16	LAST 1320	11,3623	02150 1		PBODY
0689	REF	6	LAST 1320	11,3624	50043 0		MUEARTH -2,2
0690	REF	5	LAST 1320	11,3625	36210 1		STCALL BETAM
0691	REF	2	LAST 1320	11,3626	23636 0		DOW..1
0692				11,3627	50414 0	BON	VSR8
0693	REF	29	LAST 1314	11,3630	00303 1		MOONFLAG
0694				11,3631	23632 1		+1
0695				11,3632	77655 1	VAD	
0696	REF	12	LAST 1320	11,3633	02202 0		PV
0697	REF	13	LAST 1320	11,3634	36202 1		STCALL PV
0698	REF	3	LAST 1320	11,3635	23135 1		NBRANCH
0699				11,3636	60575 0	DOW..1	VLOAD VSR4
0700	REF	46	LAST 1316	11,3637	02152 0		ALPHAV
0701				11,3640	53513 0	PDVL*	UNIT
0702	REF	9	LAST 1306	11,3641	02217 1		VECTAB,1
0703				11,3642	46315 0	PDVL	VPROJ
0704	REF	47	LAST 1320	11,3643	02152 0		ALPHAV
0705				11,3644	52361 1	VXSC	VSU
0706	REF	5	LAST 1312	11,3645	23707 0		3/4
0707				11,3646	60325 0	PDDL	NORM
0708				11,3647	00045 0		36D
0709	REF	37	LAST 1317	11,3650	00052 0		S2
0710				11,3651	63406 0	PUSH	DSQ
0711				11,3652	77605 1	DMP	
0712				11,3653	65301 0	NORM	PDDL
0713				11,3654	00043 0		34D
0714	REF	6	LAST 1320	11,3655	02210 0		BETAM
0715				11,3656	56342 1	SR1	DDV
0716				11,3657	77761 1	VXSC	
0717				11,3660	57154 0	LXA,2	XAD,2
0718	REF	36	LAST 1320	11,3661	00051 0		S2
0719	REF	39	LAST 1320	11,3662	00051 0		S2
0720				11,3663	57074 0	XAD,2	XAD,2
0721	REF	40	LAST 1320	11,3664	00051 0		S2
0722				11,3665	00042 1		34D
0723				11,3666	43457 0	VSL*	RVQ

0724				11,3667	57606 0			0 -8D,2
0725	REF	1		11,2000			SETLOC	ORBITAL$_1$
0726				11,3670			BANK	
0727				11,3670	04631 1	3/5	2DEC	.6 B-2
0727				11,3671	23146 0			
0728				11,3672	14000 1	THREE/8	2DEC	.375
0728				11,3673	00000 1			
0729				11,3674	02314 0	.3D	2DEC	.3 B-2
0729				11,3675	31463 1			
0730				11,3676	01400 1	3/64	2DEC	3 B-6
0730				11,3677	00000 1			
0731				11,3700	10000 0	DP1/4	2DEC	.25
0731				11,3701	00000 1			
0732	REF	2	LAST 1273	11,3700		DQUARTER	EQUALS	DP1/4
0733	REF	3	LAST 1321	11,3700		POS1/4	EQUALS	DP1/4
0734				11,3702	03000 1	3/32	2DEC	3 B-5
0734				11,3703	00000 1			
0735				11,3704	36000 1	15/16	2DEC	15. B -4
0735				11,3705	00000 1			
0736				11,3706	30000 1	3/4	2DEC	3.0 B -2
0736				11,3707	00000 1			
0737				11,3710	22525 0	7/12	2DEC	.5833333333
0737				11,3711	12525 0			
0738				11,3712	22000 1	9/16	2DEC	9 B -4
0736				11,3713	00000 1			
0739				11,3714	01200 1	5/128	2DEC	5 B-7
0739				11,3715	00000 1			
0740	REF	13	LAST 1315	04,3455		DPZERO	EQUALS	ZEROVEC
0741				11,3716	25252 0	DP2/3	2DEC	.6666666667
0741				11,3717	25253 1			
0742	REF	3	LAST 1316	11,3716		2/3	EQUALS	DP2/3
07455				11,3720	00027 1	OCT27	OCT	27
R0746	LM504 IS TEMPORARY							
07462				13,3715			BANK	13
07463	REF	1		13,2000			SETLOC	ORBITAL$_2$
07464				13,3715			BANK	
R0747	IT IS VITAL THAT THE FOLLOWING CONSTANTS NOT BE SHUFFLED							
0748				13,3715	77764 1		DEC	-11
0749				13,3716	77775 1		DEC	-2
6750				13,3717	77766 0		DEC	-9
0751				13,3720	77771 0		DEC	-6
0752				13,3721	77775 1		DEC	-2
0753				13,3722	77775 1		DEC	-2
0754				13,3723	00000 1		DEC	0
0755				13,3724	77763 0		DEC	-12
0756				13,3725	77766 0		DEC	-9
0757				13,3726	77773 1		DEC	-4
0758				13,3727	77770 1	ASCALE	DEC	-7
0759				13,3730	77771 0		DEC	-6

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0760                          13,3731   27446 1            2DEC*  1.32715445 E16 B-54*      S
0760                          13,3732   14820 0
0761                          13,3733   16471 1            2DEC*  4.9027780 E6 B-30*        M
0761                          13,3734   01352 1
0762                          13,3735   22437 1   MUEARTH  2DEC*  3.986032 E10 B-36*
0762                          13,3736   16067 1
0763                          13,3737   00000 1            2DEC   0
0763                          13,3740   00000 1
0764                          13,3741   02302 1   J4REQ/J3 2DEC*  .4991607391 E7 B-26*
0764                          13,3742   24736 0
0765                          13,3743   00000 1            2DEC   0
0765                          13,3744   00000 1
0766                          13,3745   77776 1   2J3R2/J2 2DEC*  -.1355426363 E5 B-27*
0766                          13,3746   53032 0
0767                          13,3747   10407 0            2DEC*  .3067493316 E16 B-60*
0767                          13,3750   05344 1
0768                          13,3751   13710 0   J2REOSQ  2DEC*  1.75501139 E21 B-72*
0768                          13,3752   35320 0
0769                          13,3753   12160 0   3J22R2MU 2DEC*  9.20479048 E16 B-56*
0769                          13,3754   12124 0
0770                          13,3755   24000 1   5/8      2DEC   5 B-3
0770                          13,3756   00000 1
0771                          13,3757   74631 0   -1/12    2DEC   -.1
0771                          13,3760   63145 1
0772  REP  9  LAST 1320       13,3733             MUM      =      MUEARTH -2
0773                          13,3781   00243 1   RECRATIO 2DEC   .01
0773                          13,3782   32703 1
0774                          13,3783   03654 0   RSPHERE  2DEC   64373 76 E3 B-29
0774                          13,3784   21000 1
0775                          13,3785   03654 0   RDM      2DEC   18093.44 E3 B-27
0775                          13,3786   21000 1
0776                          13,3767   04827 0   ROE      2DEC   80487.20 E3 B-29
0776                          13,3770   25200 1
0777                          0000                RATT     EQUALS 0D
0778                          0008                VATT     EQUALS 6D
0779                          0014                TAT      EQUALS 12D
0780                          0016                RATT1    EQUALS 14D
0781                          0024                VATT1    EQUALS 20D
0782                          0032                MU(P)    EQUALS 26D
0783                          0040                TDEC1    EQUALS 32D
0784                          0016                URPV     EQUALS 14D
0785  REP  6  LAST 1311       0022                COSPHI/2 EQUALS URPV +4
0786                          0024                UZ       EQUALS 20D
0787                          0032                TVEC     EQUALS 26D
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L .   INFLIGHT ALIGNMENT ROUTINES   USER=S PAGE NO.   1   E0 S3

0001				22,3505			BANK 22
0002	REP	·1		23,2000			SETLOC INFLIGHT
.0003				23,3140			BANK

| 0004 | REP | 34 | LAST 772 | E5,1671 | | | EBANK= XSM |

R0005 CALCGTA COMPUTES THE GYRO TORQUE ANGLES REQUIRED TO BRING THE STABLE MEMBER INTO THE DESIRED ORIENTATION.

R0007 THE INPUT IS THE DESIRED STABLE MEMBER COORDINATES REFERRED TO PRESENT STABLE MEMBER COORDINATES. THE THREE
R0009 HALF-UNIT VECTORS ARE STORED AT XDC, YDC, AND ZDC.

R0010 THE OUTPUTS ARE THE THREE GYRO TORQUING ANGLES TO BE APPLIED TO THE Y, Z, AND X GYROS AND ARE STORED DP AT IGC,
R0012 MGC, AND OGC RESPECTIVELY.

0013	REP	1						COUNT 23/INFLT	
0014				23,3140	71220 1	CALCGTA	ITA	DLOAD	PUSHDOWN 00-03,16D-27D,34D-37D
0015	REP	41	LAST 1320	23,3141	00051 0			S2	$XDC = (XD_1\ XD_2\ XD_3)$
0016	REP	5	LAST 724	23,3142	02714 1			XDC	$YDC = (YD_1\ YD_2\ YD_3)$
0017				23,3143	65325 0		PDDL	PDDL	$ZDC = (ZD_1\ ZD_2\ ZD_3)$
0018.	REP	30	LAST 1220	23,3144	15332 1			HI6ZEROS	
0019	REP	6	LAST 1323	23,3145	02720 0			XDC +4	.
0020				23,3146	55476 1		DCOMP	VDEF	
0021				23,3147	77656 1		UNIT		
0022	REP	1		23,3150	14027 1		STODL	ZPRIME	$ZP = UNIT(-XD_3\ 0\ XD_1) = (ZP_1\ ZP_2\ ZP_3)$
0023	REP ·	2	LAST 1323	23,3151	00027 1			ZPRIME	
0024·				23,3152	77742 0			SR1	
0025	REP	10	LAST 1210	23,3153	14023 0		STODL	SINTH	$SIN(IGC) = ZP_1$
0026	REP	3	LAST 1323	23,3154	00033 1			ZPRIME +4	
0027				23,3155	77742 0			SR1	
0028	REP	9	LAST 1210	23,3156	34021 0		STCALL	COSTH	$COS(IGC) = ZP_3$
0029	REP	5	LAST 838	23,3157	47211 0			ARCTRIG	
0030	REP	3	LAST 528	23,3160	16762 0		STODL	IGC	Y GYRO TORQUING ANGLE FRACTION OF REV.
0031	REP	7	LAST 1323	23,3161	02716 0			XDC +2	
0032				23,3162	77742 0			SR1	
0033	REP	11	LAST 1323	23,3163	14023 0		STODL	SINTH	$SIN(MGC) = XD_2$
0034	REP	4	LAST 1323	23,3164	00027 1			ZPRIME	
0035				23,3165	65205 0		DMP	PDDL	
0036	REP	·8	LAST 1323	23,3166	02720 0			XDC +4	$PD_{00} = (ZP_1)(XD_3)$
0037	REP	5	LAST 1323	23,3167	00033 1			ZPRIME +4	
0038				23,3170	45205 1		DMP .	DSU	
0039	REP	9	LAST 1323	23,3171	02714 1			XDC	$MPAC = (ZP_3)(XD_1)$
0040				23,3172	77626 0		STADR		
0041	REP ·10		LAST 1323	23,3173	43756 1		STCALL	COSTH	$COS(MGC) = MPAC - PD_{00}$
0042	REP	6	LAST 1323	23,3174	47211 0			ARCTRIG	

0043	REF	3	LAST	528	23,3175	26764 0	STOVL	MGC	Z GYRO TORQUING ANGLE FRACTION OF REV.
0044	REF	6	LAST	1323	23,3176	00027 1		ZPRIME	
0045					23,3177	77641 1	DOT		
0046	REF	4	LAST	534	23,3200	02730 1		ZDC	
0047	REF	11	LAST	1323	23,3201	24021 1	STOVL	COSTH	COS(OGC) = ZP . ZDC
0048	REF	7	LAST	1324	23,3202	00027 1		ZPRIME	
0049					23,3203	77641 1	DOT		
0050	REF	4	LAST	534	23,3204	02722 1		YDC	
0051	REF	12	LAST	1323	23,3205	34023 1	STCALL	SINTH	SIN(OGC) = ZP . YDC
0052	REF	7	LAST	1323	23,3206	47211 0		ARCTRIG	
0053	REF	17	LAST	714	23,3207	36760 0	STCALL	OGC	X GYRO TORQUING ANGLE FRACTION OF REV.
0054	REF	42	LAST	1323	23,3210	00051 0		S2	

L   INFLIGHT ALIGNMENT ROUTINES

R0055 ARCTRIG COMPUTES AN ANGLE GIVEN THE SINE AND COSINE OF THIS ANGLE.

R0056 THE INPUTS ARE SIN/4 AND COS/4 STORED DP AT SINTH AND COSTH.

R0057 THE OUTPUT IS THE CALCULATED ANGLE BETWEEN +.5 AND -.5 REVOLUTIONS AND STORED AT THETA. THE OUTPUT IS ALSO
R0059 AVAILABLE AT MPAC.

```
0060                        23,3211   51545 1  ARCTRIG  DLOAD  ABS       PUSHDOWN  16D-21D
0061  REF  13  LAST 1324    23,3212   00023 0                  SINTH
0062                        23,3213   50025 0           DSU    BMN
0063  REF   1              23,3214   07427 1                  OTSN45    ABS(SIN/4) - SIN(45)/4
0064  REF   1              23,3215   47224 0                  TRIG1     IF (-45,45) OR (135,-135)
0065                        23,3216   72545 0           DLOAD  SL1       (45,135) OR (-135,-45)
0066  REF  12  LAST 1324    23,3217   00021 1                  COSTH
0067                        23,3220   75328 1           ACOS   SIGN
0068  REF  14  LAST 1325    23,3221   00023 0                  SINTH
0069  REF   7  LAST 1210    23,3222   00025 0           STORE  THETA     X = ARCCOS(COS) WITH SIGN(SIN)
0070                        23,3223   77616 0           RVQ
0071                        23,3224   72545 0  TRIG1    DLOAD  SL1       (-45,45) OR (135,-135)
0072  REF  15  LAST 1325    23,3225   00023 0                  SINTH
0073                        23,3226   77738 0           ASIN
0074  REF   8  LAST 1325    23,3227   14025 0           STODL  THETA     X = ARCSIN(SIN) WITH SIGN(SIN)
0075  REF  13  LAST 1325    23,3230   00021 1                  COSTH
0076                        23,3231   77640 0           BMN
0077  REF   1              23,3232   47235 0                  TRIG2     IF (135,-135)

0078                        23,3233   43545 1           DLOAD  RVQ
0079  REF   9  LAST 1325    23,3234   00025 0                  THETA     X = ARCSIN(SIN)     (-45,45)
0080                        23,3235   75345 1  TRIG2    DLOAD  SIGN      (135,-135)
0081  REF  12  LAST 1219    23,3236   15330 0                  HIDPHALF
0082  REF  16  LAST 1325    23,3237   00023 0                  SINTH
0083                        23,3240   77625 0           DSU
0084  REF  10  LAST 1325    23,3241   00025 0                  THETA
0085  REF  11  LAST 1325    23,3242   00025 0           STORE  THETA     X = .5 WITH SIGN(SIN) - ARCSIN(SIN)
0086                        23,3243   77616 0           RVQ                         (+) - (+) OR (-) - (-)
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R0087   SMNB, NBSM, AND AXISROT, WHICH USED TO APPEAR HERE, HAVE BEEN
R0088   COMBINED IN A ROUTINE CALLED AX*SR*T, WHICH APPEARS AMONG THE POWERED
R0089   FLIGHT SUBROUTINES.

R0090 . CALCGA COMPUTES THE CDU DRIVING ANGLES REQUIRED TO BRING THE STABLE MEMBER INTO THE DESIRED ORIENTATION.

R0092   THE INPUTS ARE   1) THE NAVIGATION BASE COORDINATES REFERRED TO ANY COORDINATE SYSTEM. THE THREE HALF-UNIT
R0094   VECTORS ARE STORED AT XNB,YNB, AND ZNB. 2) THE DESIRED STABLE MEMBER COORDINATES REFERRED TO THE SAME
R0096   COORDINATE SYSTEM ARE STORED AT XSM, YSM, AND ZSM.

R0097   THE OUTPUTS ARE THE THREE CDU DRIVING ANGLES AND ARE STORED SP AT THETAD, THETAD +1, AND THETAD +2.

0099					23,3244	77601 0	CALCGA	SETPD	PUSHDOWN 00-05, 16D-21D, 34D-37D
0100					23,3245	00001 0		0	
0101					23,3246	47375 0		VLOAD VXV	
0102	REP	10	LAST	772	23,3247	02714 1		XNB	XNB = OGA (OUTER GIMBAL AXIS)
0103	REP	5	LAST	772	23,3250	02700 1		YSM	YSM = IGA (INNER GIMBAL AXIS)
0104					23,3251	41456 0		UNIT PUSH	PD0 = UNIT(OGA X IGA) = MGA
0105					23,3252	44041 1		DOT ITA	
0106	REP	7	LAST	772	23,3253	02730 1		ZNB	
0107	REP	43	LAST	1324	23,3254	00051 0		S2	
0108	REP	14	LAST	1325	23,3255	24021 1		STOVL COSTH	COS(OG) = MGA . ZNB
0109					23,3256	00001 0		0	
0110					23,3257	77641 1		DOT	
0111	REP	7	LAST	772	23,3260	02722 1		YNB	
0112	REP	17	LAST	1325	23,3261	34023 1		STCALL SINTH	SIN(OG) = MGA . YNB
0113	REP	6	LAST	1324	23,3262	47211 0		ARCTRIG	
0114	REP	18	LAST	1324	23,3263	26760 1		STOVL OGC	
0115					23,3264	00001 0		0	
0116					23,3265	50235 0		VXV DOT	PROVISION FOR MG ANGLE OF 90 DEGREES
0117	REP	11	LAST	1327	23,3266	02714 1		XNB	
0118	REP	6	LAST	1327	23,3267	02700 1		YSM	
0119					23,3270	77752 1		SL1	
0120	REP	15	LAST	1327	23,3271	24021 1		STOVL COSTH	COS(MG) = IGA . (MGA X OGA)
0121	REP	7	LAST	1327	23,3272	02700 1		YSM	
0122					23,3273	77641 1		DOT	
0123	REP	12	LAST	1327	23,3274	02714 1		XNB	
0124	REP	16	LAST	1327	23,3275	34023 1		STCALL SINTH	SIN(MG) = IGA . OGA
0125	REP	9	LAST	1327	23,3276	47211 0		ARCTRIG	
0126	REP	4	LAST	1324	23,3277	02764 0		STORE MGC	
0127					23,3300	45246 0		ABS DSU	
0128	REP	1			23,3301	07431 0		.166...	
0129					23,3302	77644 1		BPL	
0130	REP	1			23,3303	47324 1		GIMLOCK1	IF ANGLE GREATER THAN 60 DEGREES
0131					23,3304	50375 0	CALCGA1	VLOAD DOT	
0132	REP	4	LAST	772	23,3305	02706 1		ZSM	
0133					23,3306	00001 0		0	
0134	REP	16	LAST	1327	23,3307	24021 1		STOVL COSTH	COS(IG) = ZSM . MGA
0135	REP	35	LAST	1323	23,3310	02672 0		XSM	

0136					23,3311	45441 1		DOT	STADR	
0137	REF	19	LAST	1327	23,3312	43754 0		STCALL	SINTH	SIN(IG) = XSM . MGA
0138	REF	10	LAST	1327	23,3313	47211 0			ARCTRIG	
0139	REF	4	LAST	1323.	23,3314	28782 0		STOVL	IGC	
0140	REF	19	LAST	1327	23,3315	02780 1			OGC	
0141					23,3316	43034 1		RTB	BONCLR	
01415	REF	5	LAST	535	23,3317	45547 0			V1STO2S	
0142	REF	2	LAST	772	23,3320	00200 0			CPHIFLAG	
01425	REF	44	LAST	1327	23,3321	00051 0			S2	
0143	REF	20	LAST	722	23,3322	35158 0		STCALL	THETAD	
0144	REF	45	LAST	1328	23,3323	00051 0			S2	
0145					23,3324	77778 1	GIMLOCK1	EXIT		
0146	REF	38	LAST	1318	23,3325	0 5537 0		TC	ALARM	
0147					23,3326	00401 1		OCT	00401	
0148	REF	51	LAST	1317	23,3327	0 5435 0		TC	UPFLAG	GIMBAL LOCK HAS OCCURED
0149	REF	2	LAST	417	23,3330	00058 1		ADRES	GLOKFAIL	
0150	REF	241	LAST	1316	23,3331	0 6008 1		TC	INTPRET	
0151					23,3332	77650 1		GOTO		
0152	REF	1			23,3333	47304 0			CALCGA1	

R0153   AXISGEN COMPUTES THE COORDINATES OF ONE COORDINATE SYSTEM REFERRED TO ANOTHER COORDINATE SYSTEM.

R0155   THE INPUTS ARE   1) THE STAR1 VECTOR REFERRED TO COORDINATE SYSTEM A STORED AT STARAD. 2) THE STAR2 VECTOR
R0157   REFERRED TO COORDINATE SYSTEM A STORED AT STARAD +6. 3) THE STAR1 VECTOR REFERRED TO COORDINATE SYSTEM B STORED
R0159   AT LOCATION 6 OF THE VAC AREA. 4) THE STAR2 VECTOR REFERRED TO COORDINATE SYSTEM B STORED AT LOCATION 12D OF
R0161   THE VAC AREA.

R0162   THE OUTPUT DEFINES COORDINATE SYSTEM A REFERRED TO COORDINATE SYSTEM B. THE THREE HALF-UNIT VECTORS ARE STORED
R0164   AT LOCATIONS XDC, XDC +6, XDC +12D, AND STARAD, STARAD +6, STARAD +12D.

0165				23,3334	66370 0	AXISGEN	AXT,1	SSP	PUSHDOWN 00-30D,34D-37D
0166	REF	11	LAST 738	23,3335	02743 0			STARAD +6	
0167	REF	54	LAST 1310	23,3336	00051 0			S1	
0168	REF	12	LAST 1329	23,3337	02727 1			STARAD -6	
0169				23,3340	77601 0		SETPD		
0170				23,3341	00001 0			0	
0171				23,3342	46773 0	AXISGEN1	VLOAD*	VXV*	06D UA = S1
0172	REF	13	LAST 1329	23,3343	02752 0			STARAD +12D,1	STARAD +00D UB = S1
0173	REF	14	LAST 1329	23,3344	02760 1			STARAD +18D,1	
0174				23,3345	77656 1		UNIT		12D VA = UNIT(S1 X S2)
0175	REF	15	LAST 1329	23,3346	06760 0		STORE	STARAD +18D,1	STARAD +06D VB = UNIT(S1 X S2)
0176				23,3347	77773 1		VLOAD*		
0177	REF	16	LAST 1329	23,3350	02752 0			STARAD +12D,1	
0178				23,3351	76433 1		VXV*	VSL1	
0179	REF	17	LAST 1329	23,3352	02760 1			STARAD +18D,1	18D WA = UA X VA
0180	REF	16	LAST 1329	23,3353	06766 0		STORE	STARAD +24D,1	STARAD +12D WB = UB X VB
0181				23,3354	77700 0		TIX,1		
0182	REF	1		23,3355	47342 1			AXISGEN1	
0183				23,3356	66160 0		AXC,1	SXA,1	
0184				23,3357	00006 1			6	
0185				23,3360	00036 1			30D	
0186				23,3361	66370 0		AXT,1	SSP	
0187				23,3362	00022 1			18D	
0188	REF	55	LAST 1329	23,3363	00051 0			S1	
0189				23,3364	00006 1			6	
0190				23,3365	66374 1		AXT,2	SSP	
0191				23,3366	00006 1			6	
0192	REF	46	LAST 1326	23,3367	00052 0			S2	
0193				23,3370	00002 0			2	
0194				23,3371	76720 0	AXISGEN2	XCHX,1	VLOAD*	
0195				23,3372	00036 1			30D	X1=-6 X2=+6 X1=-6 X2=+4 X1=-6 X2=+2
0196				23,3373	00001 0			0,1	

L   INFLIGHT ALIGNMENT ROUTINES

Line	REP			Address	Octal	Fl	Label	Operand			
0197				23,3374	62757	0		VXSC*	PDVL*	$J=(UA)(UB_1)$ $J=((UA)(UB_2)$ $J=((UA)(UB_3)$
0198	REP	19	LAST 1329	23,3375	75033	0			STARAD +6,2	
0199				23,3376	00007	0			6,1	
0200				23,3377	77757	1		VXSC*		
0201	REP	20	LAST 1330	23,3400	75025	1			STARAD +12D,2	
0202				23,3401	30031	0		STOVL*	24D	
0203				23,3402	00015	0			12D,1	$K=(VA)(VB_1)$ $J=(VA)(VB_2)$ $J=(VA)(VB_3)$
0204				23,3403	53357	0		VXSC*	VAD	
0205	REP	21	LAST 1330	23,3404	75017	0			STARAD +18D,2	$L=(WA)(WB_1)$ $J=(WA)(WB_2)$ $J=(WA)(WB_3)$
0206				23,3405	76455	1		VAD	VSL_1	
0207				23,3406	00031	0			24D	
0208				23,3407	53520	0		XCHX,1	UNIT	
0209	REP	10	LAST 1323	23,3410	00036	1			30D	
0210				23,3411	06736	0		STORE	XDC +18D,1	$XDC = L+J+K$ $YDC = L+J+K$ $ZDC = L+J+K$
0211				23,3412	77700	0		TIX,1		
0212	REP	1		23,3413	47414	0			AXISGEN3	
0213				23,3414	77704	1	AXISGEN3	TIX,2		
0214	REP	1		23,3415	47371	1			AXISGEN2	
0215				23,3416	77775	1		VLOAD		
0216	REP	11	LAST 1330	23,3417	02714	1			XDC	
0217	REP	22	LAST 1330	23,3420	26736	1		STOVL	STARAD	
0218	REP	5	LAST 1324	23,3421	02722	1			YDC	
0219	REP	23	LAST 1330	23,3422	26744	1		STOVL	STARAD +6	
0220	REP	5	LAST 1324	23,3423	02730	1			ZDC	
0221	REP	24	LAST 1330	23,3424	02752	0		STORE	STARAD +12D	
0222				23,3425	77616	0		RVQ		

L   INFLIGHT ALIGNMENT ROUTINES

```
0281                    23,3426   05520 0   QTSN45   2DEC   .1788
0281                    23,3427   26075 1
0282                    23,3430   05252 1  .166...  2DEC   .1866666667
0282 .                  23,3431   25253 1
```

L   POWERED FLIGHT SUBROUTINES

```
0001                            14,3405        BANK    14            SAME PBANK AS THE FINDCDUD SUB-PROGRAM
0002    REF    1                23,2000        SETLOC POWFLITE
0003                            23,3432        BANK

0004    REF    1                0142           EBANK= DEXDEX
0005    REF    1                               COUNT* $$/POWFL
```

R0006   CDUTRIG, CDUTRIG1, CDUTRIG2, AND CD*TR*GS ALL COMPUTE THE SINES AND
R0007   COSINES OF THREE 2=S COMPLEMENT ANGLES AND PLACE THE RESULT, DOUBLE
R0008   PRECISION, IN THE SAME ORDER AS THE INPUTS, AT SINCDU AND COSCDU.   AN
R0009   ADDITIONAL OUTPUT IS THE 1=S COMPLEMENT ANGLES AT CDUSPOT.   THESE
R0010   ROUTINES GO OUT OF THEIR WAY TO LEAVE THE MPAC AREA AS THEY FIND IT,
R0011   EXCEPT FOR THE GENERALLY UNIMPORTANT MPAC +2.   THEY DIFFER ONLY IN
R0012   WHERE THEY GET THE ANGLES, AND IN METHOD OF CALLING.

R0013   CDUTRIG (AND CDUTRIG1, WHICH CAN BE CALLED IN BASIC) COMPUTE THE
R0014   SINES AND COSINES FROM THE CURRENT CONTENTS OF THE CDU REGISTERS.
R0015   THE CONTENTS OF CDUTEMP, ETC., ARE NOT TOUCHED SO THAT THEY MAY
R0016   CONTINUE TO FORM A CONSISTENT SET WITH THE LATEST PIPA READINGS.

R0017   CDUTRIG1 IS LIKE CDUTRIG EXCEPT THAT IT CAN BE CALLED IN BASIC.

R0018   CD*TR*GS FINDS CDU VALUES IN CDUSPOT RATHER THAN IN CDUTEMP.   THIS
R0019   ALLOWS USERS TO MAKE TRANSFORMATIONS USING ARBITRARY ANGLES, OR REAL
R0020   ANGLES IN AN ORDER OTHER THAN X Y Z.   A CALL TO THIS ROUTINE IS
R0021   NECESSARY IN PREPARATION FOR A CALL TO AX*SR*T IN EITHER OF ITS TWO
R0022   MODES (SMNB OR NBSM).   SINCE AX*SR*T EXPECTS TO FIND THE SINES AND
R0023   COSINES IN THE ORDER Y Z X THE ANGLES MUST HAVE BEEN PLACED IN CDUSPOT
R0024   IN THIS ORDER.   CD*TR*GS NEED NOT BE REPEATED WHEN AX*SR*T IS CALLED
R0025   MORE THAN ONCE, PROVIDED THE ANGLES HAVE NOT CHANGED.   NOTE THAT SINCE
R0026   IT CLOBBERS BUP2 (IN THE SINE AND COSINE ROUTINES) CD*TR*GS CANNOT BE
R0027   CALLED USING BANKCALL.   SORRY.

R0028   CD*TR*G IS LIKE CD*TR*GS EXCEPT THAT IT CAN BE CALLED IN
R0029   INTERPRETIVE.

```
0030                            23,3432    77776 1  CDUTRIG  EXIT
0031    REF    1                23,3433    0 3442 0           TC      CDUTRIGS
0032    REF  242   LAST 1326    23,3434    0 6006 1           TC      INTPRET
0033                            23,3435    77616 0           RVQ

0034                            23,3436    77776 1  CD*TR*G  EXIT
0035    REF    1                23,3437    0 3450 0           TC      CD*TR*GS
0036    REF  243   LAST 1333    23,3440    0 6006 1           TC      INTPRET
0037                            23,3441    77616 0           RVQ

0038    REF   28   LAST 1034    23,3442    3 0032 0  CDUTRIGS CA      CDUX
0039    REF    6   LAST  535    23,3443    54 772 1           TS      CDUSPOT +4
0040    REF   16   LAST 1034    23,3444    3 0033 1           CA      CDUY
0041    REF    7   LAST 1333    23,3445    54 766 1           TS      CDUSPOT
```

0042	REP	22	LAST 1034	23,3446	3 0034 0		CA	CDUZ
0043	REP	8	LAST 1333	23,3447	54 770 0		TS	CDUSPOT +2
0044				23,3450	0 0006 1	CD*TR*GS	EXTEND	
0045	REP	4	LAST 69	23,3451	22 142 0		QXCH	TEM2
0046	REP	17	LAST 1152	23,3452	3 4710 0		CAF	FOUR
0047	REP	37	LAST 1122	23,3453	7 6211 1	TR*GL**P	MASK	SIX	MAKE IT EVEN AND SMALLER
0048	REP	3	LAST 69	23,3454	54 143 0		TS	TEM3
0049	REP	4	LAST 1334	23,3455	50 143 1		INDEX	TEM3
0050	REP	9	LAST 1334	23,3456	3 0766 0		CA	CDUSPOT
0051	REP	659	LAST 1311	23,3457	52 155 1		DXCH	MPAC	STORING 2*S COMP ANGLE, LOADING MPAC
0052	REP	53	LAST 1148	23,3460	52 127 1		DXCH	VBUF +4	STORING MPAC FOR LATER RESTORATION
0053	REP	1		23,3461	0 4652 1		TC	USPRCADR
0054	REP	10	LAST 837	23,3462	45510 1		CADR	CDULOGIC
0055				23,3463	0 0006 1		EXTEND	
0056	REP	660	LAST 1334	23,3464	3 0155 0		DCA	MPAC
0057	REP	5	LAST 1334	23,3465	50 143 1		INDEX	TEM3
0058	REP	10	LAST 1334	23,3466	52 767 0		DXCH	CDUSPOT	STORING 1*S COMPLEMENT ANGLE
0059	REP	2	LAST 1334	23,3467	0 4652 1		TC	USPRCADR
0060	REP	2	LAST 1088	23,3470	01516 1		CADR	COSINE
0061	REP	661	LAST 1334	23,3471	52 155 1		DXCH	MPAC
0062	REP	6	LAST 1334	23,3472	50 143 1		INDEX	TEM3
0063	REP	4	LAST 72	23,3473	52 745 0		DXCH	COSCDU	STORING COSINE
0064				23,3474	0 0006 1		EXTEND	
0065	REP	7	LAST 1334	23,3475	5 0143 1		INDEX	TEM3
0066	REP	11	LAST 1334	23,3476	3 0767 1		DCA	CDUSPOT	LOADING 1*S COMPLEMENT ANGLE
0067	REP	3	LAST 1334	23,3477	0 4652 1		TC	USPRCADR
0068	REP	2	LAST 1088	23,3500	01530 0		CADR	SINE +1	SINE +1 EXPECTS ARGUMENT IN A AND L
0069	REP	54	LAST 1334	23,3501	52 127 1		DXCH	VBUF +4	BRINGING UP PRIOR MPAC TO BE RESTORED
0070	REP	662	LAST 1334	23,3502	52 155 1		DXCH	MPAC
0071	REP	8	LAST 1334	23,3503	50 143 1		INDEX	TEM3
0072	REP	4	LAST 72	23,3504	52 737 0		DXCH	SINCDU
0073	REP	9	LAST 1334	23,3505	10 143 0		CCS	TEM3
0074	REP	1		23,3506	1 3453 1		TCF	TR*GL**P
0075	REP	5	LAST 1334	23,3507	0 0142 0		TC	TEM2

L   POWERED FLIGHT SUBROUTINES   USER-S PAGE NO.   3   E0 83

F0076   **

R0078   QUICTRIG, INTENDED FOR GUIDANCE CYCLE USE WHERE TIME IS CRITICAL, IS A MUCH FASTER VERSION OF CD*TR*GS.
R0080   QUICTRIG COMPUTES AND STORES THE SINES AND COSINES OF THE 2-S COMPLEMENT ANGLES AT CDUSPOT, CDUSPOT +2,
R0082   AND CDUSPOT +4.   UNLIKE CD*TR*GS, QUICTRIG DOES NOT LEAVE THE 1-S COMPLEMENT VERSIONS OF THE ANGLES IN
R0084   CDUSPOT.   QUICTRIG-S EXECUTION TIME IS 4.1 MS

80096 CALLED FROM INTERPRETIVE AS AN RTB OP-CODE, OR FROM BASIC VIA BANKCALL OR IBNKCALL.

0090					23,3510	0 0004 0	QUICTRIG	INHINT		INHINT SINCE DAP USES THE SAME TEMPS
00901					23,3511	0 0006 1		EXTEND		
00902	REP	11	LAST	225	23,3512	22 061 0		QXCH	ITEMP1	
0091	REP	18	LAST	1334	23,3513	3 4710 0		CAF	FOUR	
0092	REP	38	LAST	1334	23,3514	7 6211 1	+4	MASK	SIX	
0093	I REP	10	LAST	223	23,3515	54 062 1		TS	ITEMP2	
0094	REP	11	LAST	1335	23,3516	50 082 0		INDEX	ITEMP2	
0095	REP	12	LAST	1334	23,3517	3 0766 0		CA	CDUSPOT	
0096	REP	8	LAST	1044	23,3520	0 4770 0		TC	SPSIN	
0097					23,3521	0 0006 1		EXTEND		
0098	REP	73	LAST	1205	23,3522	7 4875 0		MP	BIT14	SCALE DOWN TO MATCH INTERPRETER OUTPUTS
0099	REP	12	LAST	1335	23,3523	50 082 0		INDEX	ITEMP2	
0100	REP	5	LAST	1334	23,3524	52 737 0		DXCH	SINCDU	
0101	REP	13	LAST	1335	23,3525	50 082 0		INDEX	ITEMP2	
0102	REP	13	LAST	1335	23,3526	3 0766 0		CA	CDUSPOT	
0103	REP	7	LAST	1044	23,3527	0 4787 0		TC	SPCOS	
0104					23,3530	0 0006 1		EXTEND		
0105	REP	74	LAST	1335	23,3531	7 4875 0		MP	BIT14	
0106	REP	14	LAST	1335	23,3532	50 082 0		INDEX	ITEMP2	
0107	REP	5	LAST	1334	23,3533	52 745 0		DXCH	COSCDU	
0108	REP	15	LAST	1335	23,3534	10 062 1		CCS	ITEMP2	
0109	/ REP	2	LAST	661	23,3535	1 3514 0		TCF	QUICTRIG +4	
01091	REP	12	LAST	1335	23,3536	3 0061 0		CA	ITEMP1	
0110					23,3537	0 0003 1		RELINT		
01101	REP	341	LAST	1294	23,3540	0 0000 1		TC	A	
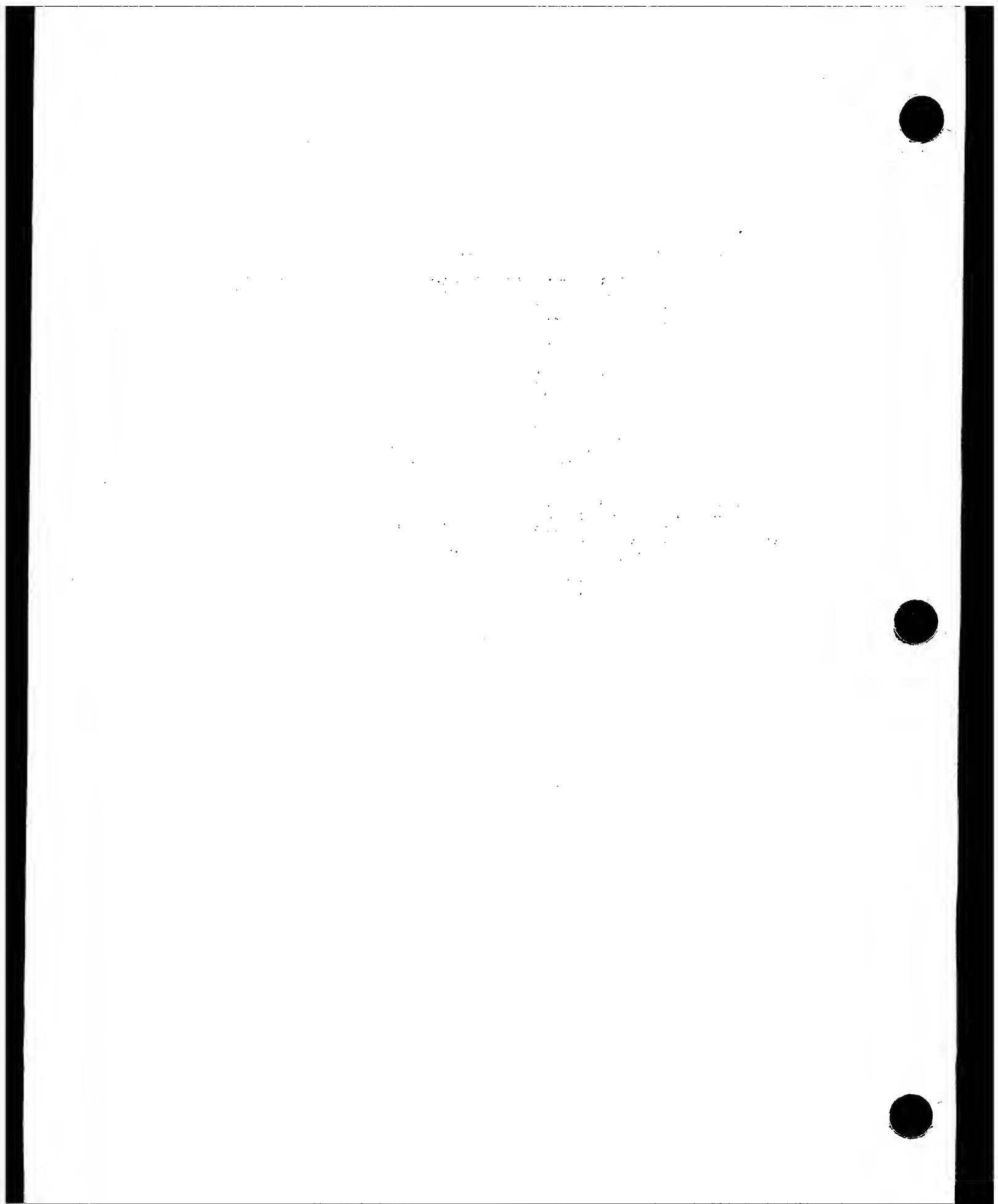
L   POWERED FLIGHT SUBROUTINES   USER=S PAGE NO.   4   E0 S3

R0111   **
R0113   THESE INTERFACE ROUTINES MAKE IT POSSIBLE TO CALL AX*SR*T, ETC., IN
R0114   INTERPRETIVE.   LATER, WHERE POSSIBLE, THEY WILL BE ELIMINATED.

R0115   NBSM WILL BE THE FIRST TO GO.   IT SHOULD NOT BE USED.

0116				23,3541	77620 0	NBSM	STQ	
0117	REF	37	LAST 1311	23,3542	00047 1			X2
0118				23,3543	76740 0		LXC,1	VLOAD*
0119	REF	56	LAST 1329	23,3544	00050 1			S1	BASE ADDRESS OF THE CDU ANGLES IS IN S1
0120				23,3545	00001 0			0,1
0121	REF	14	LAST 1335	23,3546	24767 1		STOVL	CDUSPOT
0122				23,3547	00041 1			32D	VECTOR TO BE TRANSFORMED IS IN 32D
0123				23,3550	77624 1		CALL	
0124	REF	2	LAST 447	23,3551	47572 1			TRG*NBSM
0125				23,3552	34041 0		STCALL	32D	SINCE THERE=S NO STGOTO
0126	REF	38	LAST 1336	23,3553	00047 1			X2

R0127   THESE INTERFACE ROUTINES ARE PERMANENT.   ALL RESTORE USER=S EBANK
R0128   SETTING.   ALL ARE STRICT INTERPRETIVE SUBROUTINES, CALLED USING sCALLs,
R0129   RETURNING VIA QPRET.   ALL EXPECT AND RETURN THE VECTOR TO BE TRANSFOR-
R0130   MED INTERPRETER-STYLE IN MPAC
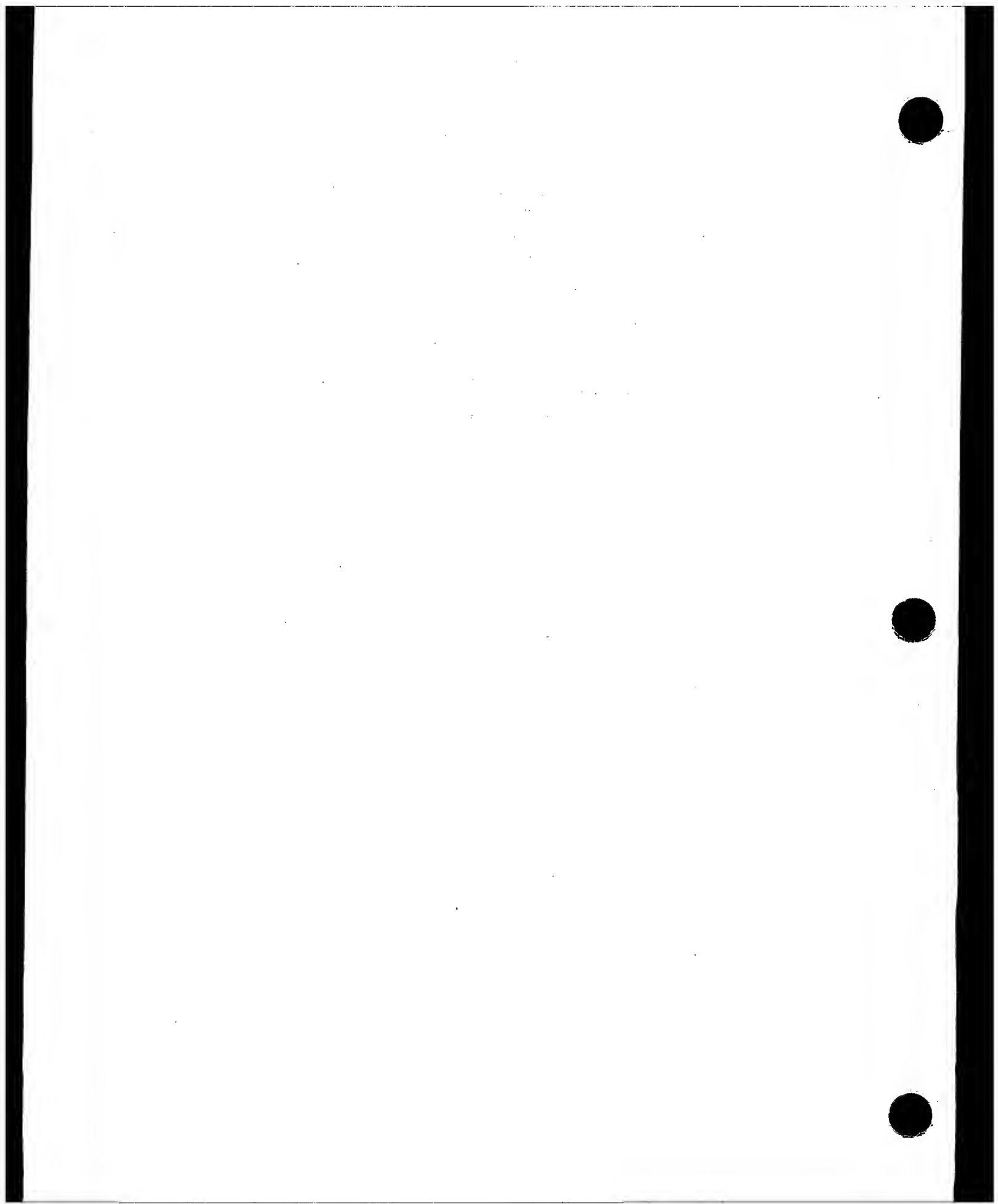
1336-A

R0131   TRG*SMNB AND TRG+NBSM BOTH EXPECT TO SEE THE 2ΩS COMPLEMENT ANGLES
R0132   AT CDUSPOT (ORDER Y Z X, AT CDUSPOT, CDUSPOT +2, AND CDUSPOT +4

1336-B

R0133   LOCATIONS NEED NOT BE ZEROED).   TRG+NBSM DOES THE NB TO SM TRANSFOR-
R0134   MATION

R0135   CDU*NBSM DOES ITS TRANSFORMATION USING THE PRESENT CONTENTS OF
R0136   THE CDU COUNTERS.   OTHERWISE IT IS LIKE TRG*NBSM.

R01361   CDU*SMNB IS THE COMPLEMENT OF CDU*NBSM.

01362				23,3554	77776 1	CDU*SMNB	EXIT	
01363	REF	2	LAST 1333	23,3555	0 3442 0		TC	CDUTRIGS
01364	REF	1		23,3556	1 3561 1		TCF	C*M*N1
0137				23,3557	77776 1	TRG*SMNB	EXIT	
0138	REF	2	LAST 1333	23,3560	0 3450 0		TC	CD*TR*GS
0139	REF	3	LAST 1145	23,3561	0 7501 1	C*M*N1	TC	MPACVBUF
0140	REF	42	LAST 1174	23,3562	4 6214 1		CS	THREE
0141	REF	1		23,3563	0 3603 1	C*M*N2	TC	AX*SR*T
0142	REF	244	LAST 1333	23,3564	0 6006 1		TC	INTPRET
0143				23,3565	43575 1		VLOAD	RVO
0144	REF	55	LAST 1334	23,3566	00123 1			VBUF
0145				23,3567	77776 1	CDU*NBSM	EXIT	
0146	REF	3	LAST 1336	23,3570	0 3442 0		TC	CDUTRIGS

AX*SR*T EXPECTS VECTOR IN VBUF
SIGNAL FOR SM TO NB TRANSFORMATION

```
0147   REF    1                    23,3571  1 3574 0            TCP    C*M*M*N3

0148                               23,3572  77776 1   TRG*NBSM  EXIT
0149   REF    3  LAST 1336         23,3573  0 3450 0            TC     CD*TR*GS
0150   REF    4  LAST 1336         23,3574  0 7501 1  C*M*M*N3  TC     MPACVBUF        FOR AX*SR*T
0151   REF    43 LAST 1336         23,3575  3 6214 0            CA     THREE           SIGNAL FOR NB TO SM TRANSFORMATION
0152   REF    1                    23,3576  1 3563 0            TCP    C*M*M*N2
```

R0153   *NBSM* AND *SMNB* EXPECT TO SEE THE SINES AND COSINES (AT SINCDU
R0154   AND COSCDU) RATHER THAN THE ANGLES THEMSELVES. OTHERWISE THEY ARE
R0155   LIKE TRG*NBSM AND TRG*SMNB.

R0156   NOTE THAT JUST AS CD*TR*GS NEED BE CALLED ONLY ONCE FOR EACH SERIES
R0157   OF TRANSFORMATIONS USING THE SAME ANGLES, SO TOO ONLY ONE OF TRG*NBSM
R0158   AND TRG*SMNB NEED BE CALLED FOR EACH SERIES. FOR SUBSEQUENT TRANSFOR-
R0159   MATIONS USE *NBSM* AND *SMNB*.

```
0160                               23,3577  77776 1   *SMNB*    EXIT
0161   REF    2  LAST 1336         23,3600  1 3561 1            TCP    C*M*M*N1

0162                               23,3601  77776 1   *NBSM*    EXIT
0163   REF    2  LAST 1337         23,3602  1 3574 0            TCP    C*M*M*N3
```

R0164   AX*SR*T COMBINES THE OLD SMNB AND NBSM. FOR THE NB TO SM
R0165   TRANSFORMATION, ENTER WITH +3 IN A. FOR SM TO NB, ENTER WITH -3.
R0166   THE VECTOR TO BE TRANSFORMED ARRIVES, AND IS RETURNED, IN VBUF.
R0167   AX*SR*T EXPECTS TO FIND THE SINES AND COSINES OF THE ANGLES OF ROTATION
R0168   AT SINCDU AND COSCDU, IN THE ORDER Y Z X. A CALL TO CD*TR*GS, WITH
R0169   THE 2*S COMPLEMENT ANGLES (ORDER Y Z X) AT CDUSPOT, WILL TAKE CARE OF
R0170   THIS. HERE IS A SAMPLE CALLING SEQUENCE'-

R0171   TC   CDUTRIGS
R0172   CS   THREE   (ßCA   THREEß FOR NBSM)
R0173   TC   AX*SR*T

R0174   THE CALL TO CD*TR*GS NEED NOT BE REPEATED, WHEN AX*SR*T IS CALLED MORE
R0175   THAN ONCE, UNLESS THE ANGLES HAVE CHANGED.

R0176   AX*SR*T IS GUARANTEED SAFE ONLY FOR VECTORS OF MAGNITUDE LESS THAN
R0177   UNITY. A LOOK AT THE CASE IN WHICH A VECTOR OF GREATER MAGNITUDE
R0178   HAPPENS TO LIE ALONG AN AXIS OF THE SYSTEM TO WHICH IT IS TO BE TRANS-
R0179   FORMED CONVINCES ONE THAT THIS IS A RESTRICTION WHICH MUST BE ACCEPTED.

```
0180   REF    2  LAST 1333         23,3603  54 142 1  AX*SR*T   TS .   DEXDEX     WHERE IT BECOMES THE INDEX OF INDEXES
0181                               23,3604  0 0006 1            EXTEND
0182   REF    1                    23,3605  22 145 1            QXCH   RTNSAVER

0183   REF    3  LAST 1337         23,3606  10 142 1  R*TL**P   CCS    DEXDEX            +3 --δ 0      -3 --δ 2
0184   REF    4  LAST 1337         23,3607  4 0142 1            CS     DEXDEX     THUS'  +2 --δ 1      -2 --δ 1
0185   REF    44 LAST 1337         23,3610  6 6214 0            AD     THREE             +1 --δ 2      -1 --δ 0
```

0166				23,3611	0 0006 1		EXTEND		
0187	REF	342	LAST 1335	23,3612	5 0000 1		INDEX	A	
0188	REF	1		23,3613	3 3672 1		DCA	INDEXI	
0189	REF	1		23,3614	52 144 1		DXCH	DEXI	
0190	REF	156	LAST 1295	23,3615	3 4712 1		CA	ONE	
0191	REF	122	LAST 1189	23,3616	54 130 1		TS	BUF	
0192				23,3617	0 0008 1		EXTEND		
0193	REF	2	LAST 69	23,3620	5 0143 1		INDEX	DEX1	
0194	REF	58	LAST 1336	23,3621	4 0123 0		DCS	VBUF	
0195	REF	1		23,3622	1 3624 0		TCF	LOOP1	
0196	REF	123	LAST 1338	23,3623	52 131 0	LOOP2	DXCH	BUF	LOADING VECTOR COMPONENT, STORING INDEX
0197	REF	683	LAST 1334	23,3624	52 155 1	LOOP1	DXCH	MPAC	
0198	REF	1		23,3625	3 3670 0		CA	SINESLOC	
0199	REF	3	LAST 1336	23,3626	6 0143 1		AD	DEX1	
0200	REF	78	LAST 1151	23,3627	54 116 0		TS	ADDRWD	
0201	REF	21	LAST 1180	23,3630	0 7058 0		TC	DMPSUB	MULTIPLY BY SIN(CDUANGLE)
0202	REF	5	LAST 1337	23,3631	10 142 1		CCS	DEXDEX	
0203	REF	664	LAST 1338	23,3632	52 155 1		DXCH	MPAC	NBSM CASE
0204				23,3633	1 3636 0		TCF	+3	
0205				23,3634	0 0008 1		EXTEND		SMNB CASE
0206	REF	665	LAST 1338	23,3635	4 0155 0		DCS	MPAC	
0207	REF	1		23,3636	52 134 0		DXCH	TERM1TMP	
0208	REF	39	LAST 1335	23,3637	3 8211 0		CA	SIX	SINCDU AND COSCDU (EACH 6 WORDS) MUST
0209	REF	79	LAST 1336	23,3640	26 116 0		ADS	ADDRWD	BE CONSECUTIVE AND IN THAT ORDER
0210				23,3641	0 0006 1		EXTEND		
0211	REF	124	LAST 1336	23,3642	5 0130 0		INDEX	BUF	
0212	REF	4	LAST 1338	23,3643	5 0143 1		INDEX	DEX1	
0213	REF	57	LAST 1338	23,3644	3 0123 1		DCA	VBUF	
0214	REF	668	LAST 1338	23,3645	52 155 1		DXCH	MPAC	
0215	REF	22	LAST 1338	23,3646	0 7056 0		TC	DMPSUB	MULTIPLY BY COS(CDUANGLE)
0216	REF	667	LAST 1338	23,3647	52 155 1		DXCH	MPAC	
0217	REF	2	LAST 1336	23,3650	20 134 0		DAS	TERM1TMP	
0218	REF	3	LAST 1338	23,3651	52 134 0		DXCH	TERM1TMP	
0219				23,3652	20 001 1		DDOUBL		
0220	REF	125	LAST 1338	23,3653	50 130 0		INDEX	BUF	
0221	REF	5	LAST 1338	23,3654	50 143 1		INDEX	DEX1	
0222	REF	58	LAST 1336	23,3655	52 123 0		DXCH	VBUF	
0223	REF	128	LAST 1338	23,3656	52 131 0		DXCH	BUF	
0224	REF	343	LAST 1338	23,3657	10 000 0		CCS	A	LOADING INDEX, STORING VECTOR COMPONENT
0225	REF	1		23,3660	1 3623 1		TCF	LOOP2	=CAUSE THAT=S WHERE THE INDEX NOW IS
0226				23,3661	0 0006 1		EXTEND		
0227	REF	6	LAST 1338	23,3662	26 142 1		DIM	DEXDEX	DECREMENT MAGNITUDE PRESERVING SIGN

REALLY BE A SUBTRACT, AND VICE VERSA

L   POWERED FLIGHT SUBROUTINES

0228	REP	7	LAST 1338	23,3663	10 142 1	TSTPOINT	CCS	DEXDEX	ONLY THE BRANCHING FUNCTION IS USED
0229	REP	1		23,3664	1 3606 0		TCF	R*TL**P	
0230	REP	2	LAST 1337	23,3665	0 0145 1		TC	RTNSAVER	
0231	REP	2	LAST 1339	23,3666	1 3606 0		TCF	R*TL**P	
0232	REP	3	LAST 1339	23,3667	0 0145 1		TC	RTNSAVER	
0233	REP	6	LAST 1335	23,3670	00736 0	SINESLOC	ADRES	SINCDU	FOR USE IN SETTING ADDRWD
0234				23,3671	00004 0	INDEXI	DEC	4	********* DON*T *********
0235				23,3672	00002 0		DEC	2	********* TOUCH *********
0236				23,3673	00000 1		DEC	0	********* THESE *********
0237				23,3674	00004 0		DEC	4	********* CONSTANTS *********
R0238	**								

L   POWERED FLIGHT SUBROUTINES

P0240   THIS SUBROUTINE COMPUTES INCREMENTAL CHANGES IN CDU(GIMBAL) ANGLES FROM INCREMENTAL CHANGES ABOUT SM AXES. IT
R0242   REQUIRES SM INCREMENTS AS A DP VECTOR SCALED AT ONE REVOLUTION(DTHETASM,+2,+4). SIN,COS(CDUY,Z,X) ARE IN
R0244   SINCDU,+2,+4 AND COSCDU,+2,+4 RESPECTIVELY,SCALED TO ONE HALF. CDU INCREENTS ARE PLACED IN DCDU,+2,+4 SCALED TO
R0246   ONE REVOLUTION.

R0247	*	COS(IGA)SEC(MGA)	0	-SIN(IGA)SEC(MGA) *
R0248	*			*
R0249	*	-COS(IGA)TAN(MGA)	1	SIN(IGA)TAN(MGA) *
R0250	*			*
R0251	*	SIN(IGA)	0	COS(IGA) *

0252				14,3405			BANK	14	
0253	REP	1		23,2000			SETLOC	POWFLIT1	
0254				23,3675			BANK		
0255				23,3675	41345 0	SMCDURES	DLOAD	DMP	
0256	REP	7	LAST 584	23,3676	03212 0			DTHETASM	
0257	REP	4	LAST 716	23,3677	00745 1			COSCDUY	
0258				23,3700	41325 0		PDDL	DMP	
0259	REP	8	LAST 1340	23,3701	03216 1			DTHETASM +4	
0260	REP	4	LAST 716	23,3702	00737 1			SINCDUY	
0261				23,3703	77621 1		BDSU		
0262				23,3704	77671 1		DDV		
0263	REP	7	LAST 930	23,3705	00747 0			COSCDUZ	
0264	REP	6	LAST 586	23,3706	03204 1		STORE	DCDU	
0265				23,3707	72405 0		DMP	SL1	SCALE
0266	REP	4	LAST 716	23,3710	00741 0			SINCDUZ	
0267				23,3711	77621 1		BDSU		
0268	REP	9	LAST 1340	23,3712	03214 0			DTHETASM +2	
0269	REP	7	LAST 1340	23,3713	17206 0		STODL	DCDU +2	
0270	REP	10	LAST 1340	23,3714	03212 0			DTHETASM	
0271				23,3715	65205 0		DMP	PDDL	
0272	REP	5	LAST 1340	23,3716	00737 1			SINCDUY	
0273	REP	11	LAST 1340	23,3717	03216 1			DTHETASM +4	
0274				23,3720	43205 1		DMP	DAD	
0275	REP	5	LAST 1340	23,3721	00745 1			COSCDUY	
0276				23,3722	77752 1		SL1		
0277	REP	8	LAST 1340	23,3723	03210 1		STORE	DCDU +4	
0278				23,3724	77616 0		RVQ		

L   TIME OF FREE PALL   USER=S PAGE NO.   1   E0 53

R0001   THE TPF SUBROUTINES MAY BE USED IN EITHER EARTH OR MOON CENTERED COORDINATES. THE TPF ROUTINES NEVER
R0003   KNOW WHICH ORIGIN APPLIES. IT IS THE USER WHO KNOWS, AND WHO SUPPLIES RONE, VONE AND 1/SQRT(MU) AT THE
R0005   APPROPRIATE SCALE LEVEL FOR THE PROPER PRIMARY BODY.

R0006   EARTH ORIGIN   POSITION   -29   METERS
R0007   VELOCITY   -7   METERS/CENTISECOND
R0009   1/SQRT(MU)   +17   SQRT(CS SQ/METERS CUBED)

R0011   MOON ORIGIN   POSITION   -27   METERS
R0012   VELOCITY   -5   METERS/CENTISECONDS
R0014   1/SQRT(MU)   +14   SQRT(CS SQ/METERS CUBED)

R0016   ALL DATA PROVIDED TO AND RECEIVED FROM ANY TPF SUBROUTINE WILL BE AT ONE OF THE LEVELS ABOVE. IN ALL CASES,
R0018   THE FREE FALL TIME IS RETURNED IN CENTISECONDS AT (-28). PROGRAM TPF/CONIC WILL GENERATE VONE/RTMU AND
R0020   LEAVE IT IN VONE AT (+10) IF EARTH ORIGIN AND (+9) IF MOON ORIGIN.
R0021   THE USER MUST STORE THE STATE VECTOR IN RONE, VONE AND MU IN THE FORM 1/SQRT(MU) IN TPF/RTMU
R0023   AT THE PROPER SCALE BEFORE CALLING TPF/CONIC. SINCE RONE, VONE ARE IN THE EXTENDED VERB STORAGE AREA,
R0025   THE USER MUST ALSO LOCK OUT THE EXTENDED VERBS, AND RELEASE THEM WHEN FINISHED.
R0027   PROGRAMS   CALC/TFF AND CALC/TPER ASSUME THAT THE TERMINAL RADIUS IS LESS THAN THE PRESENT
R0029   RADIUS. THIS RESTRICTION CAN BE REMOVED BY A 15 W CODING CHANGE, BUT AT PRESENT IT IS NOT DEEMED NECESSARY.
R0031
R0032   THE FOLLOWING ERASABLE QUANTITIES ARE USED BY THE TPF ROUTINES, AND ARE LOCATED IN THE PUSH LIST.
R0034

A0035   BELOW   E'   IS USED FOR EARTH ORIGIN SCALE
A0036   M'   IS USED FOR MOON ORIGIN SCALE

A0037   TFFSW   =   119D BIT1   0 = CALCTFF   1 = CALCTPER
 0038   0012   TFFDELQ =   16D   Q2-Q1   E' (-16) M' (-15)
 0039   0014   RMAG1   =   12D   ABVAL(RN) M   E' (-29) M' (-27)
A0040   RPER   =   14D   PERIGEE RADIUS M E' (-29) M' (-27)
 0041   0016   TFFPQ1   =   14D   R.V / SQRT(MUE) E' (-16) M' (-15)
A0042   SDELF/2   SIN(THETA) /2
 0043   0016   CDELF/2 =   14D   COS(THETA) /2
A0044   RAPO   =   16D   APOGEE RADIUS M   E' (-29) M' (-27)
 0045   0020   RTERM   =   16D   TERMINAL RADIUS M E' $(-29+NR)$
A0046   M' $(-27+NR)$
 0047   0022   RTERM   =   18D   TERMINAL RADIUS M E' (-29) M' (-27)
 0048   0024   TFFVSQ   =   20D   -(V SQUARED/MU) 1/M E' (20) M' (18)
 0049   0026   TFF1/ALF =   22D   SEMI MAJ AXIS M   E' $(-22-2\ NA)$
A0050   M' $(-20-2\ NA)$
 0051   0030   TFFRTALF =   24D   SQRT(ALPA) E' $(10+NA)$ M' $(9+NA)$
 0052   0032   TFFALPA =   26D   ALPA 1/M   E' $(28-NR)$ M' $(24-NR)$
 0053   0034   TFFNP   =   28D   SEMI LATUS RECTUM M E' $(-38+2\ NR)$
A0054   M' $(-36+2\ NR)$
 0055   0036   TFF/RTMU =   30D   1/SQRT(MU)   E' (17) M' (14)
 0056   0040   RNMAG   =   32D   PRESENT RADIUS M E' $(-29+NR)$
A0057   M' $(-27+NR)$
 0058   0042   TFFX   =   34D
 0059   0044   TFFTEM   =   36D   TEMPORARY

L   TIME OF FREE FALL

A0060   REGISTERS S1, S2 ARE UNTOUCHED BY ANY TFF SUBROUTINE
A0061   INDEX REGISTERS X1, X2 ARE USED BY ALL TFF SUBROUTINES. THEY ARE ESTAB-
A0062   LISHED IN TFF/CONIC AND MUST BE PRESERVED BETWEEN CALLS TO SUBSEQUENT
A0063   SUBROUTINES.
A0064   -NR $C(X_1) =$ NORM COUNT OF RMAG
A0065   -NA $C(X_2) =$ NORM COUNT OF SQRT(ABS(ALFA))

P0066

R0067	SUBROUTINE NAME'	TFPCONIC			DATE' 01.29.67
R0069	MOD NO' 0				LOG SECTION' TIME OF FREE FALL
R0071	MOD BY' RR BAIRNSFATHER				
R0072	MOD BY' 1	MOD BY' RR BAIRNSFATHER	DATE' 11 APR 67		
R0073	MOD NO' 2	MOD BY' RR BAIRNSFATHER	DATE' 21 NOV 67	ADD MOON MU.	
R0075	MOD NO' 3	MOD BY' RR BAIRNSFATHER	DATE' 21 MAR 68	ACCEPT DIFFERENT EARTH/MOON SCALES	

R0077 FUNCTIONAL DESCRIPTION'   THIS SUBROUTINE IS CALLED TO COMPUTE THOSE CONIC PARAMETERS REQUIRED BY THE TFP
R0079   SUBROUTINES AND TO ESTABLISH THEM IN THE PUSH LIST AREA. THE PARAMETERS ARE LISTED UNDER OUTPUT.
R0081   THE EQUATIONS ARE

R0082
R0083 $\bar{H} = \bar{RN} * \bar{VN}$ ANGULAR MOMENTUM
R0085
R0086 $LCP = \bar{H}.\bar{H} / MU$ SEMI LATUS RECTUM
R0088
R0089 $ALFA = 2/RN - \bar{VN}.\bar{VN} / MU$ RECIPROCAL SEMI MAJ AXIS, SIGNED

R0091   AND ALFA IS POS FOR ELLIPTIC ORBITS
R0092   0 FOR PARABOLIC ORBITS
R0093   NEG FOR HYPERBOLIC ORBITS.
R0094   SUBROUTINE ALSO COMPUTES AND SAVES RMAG.
R0095 CALLING SEQUENCE'
R0096   TFPCONIC EXPECTS CALLER TO ENTER WITH CORRECT GRAVITATIONAL CONSTANT IN MPAC, IN THE FORM
R0098   1/SQRT(MU). PROGRAM WILL SAVE IN TFP/RTMU . THE SCALE IS DETERMINED BY WHETHER EARTH OR MOON
R0100   ORIGIN IS USED. THE CALLER MUST LOCK OUT THE EXTENDED VERBS BEFORE PROVIDING STATE VECTOR IN RONE,
R0102   VONE AT PROPER SCALE. THE EXTENDED VERBS MUST BE RESTORED WHEN THE CALLER IS FINISHED USING THE
R0104   TFP ROUTINES.
R0105   ENTRY POINT TFPCONMU EXPECTS THAT TFP/RTMU IS ALREADY LOADED.
R0107   TO SPECIFY MU'   DLOAD   CALL   IF MU ALREADY STORED'   CALL
R0109   YOURMU   1/RTMU   E' (17) M' (14)   TFPCONMU
R0111   TFPCONIC
R0112   PUSHLOC = PDL+0, ARBITRARY IF LEQ 18D

R0113 SUBROUTINES CALLED' NONE
R0114 NORMAL EXIT MODES' RVQ
R0115 ALARMS' NONE
R0116 OUTPUT' THE FOLLOWING ARE STORED IN THE PUSH LIST AREA.
R0117   RMAG1 E'(-29) M'(-27) M RN, PRESENT RADIUS LENGTH.
R0118   NRMAG E' (-29+NR)   M RMAG, NORMALIZED
R0119   M' (-27+NR)
R0120   X1   -NR, NORM COUNT
R0121   TFPNP E' (-38+2NR)   M LCP, SEMI LATUS RECTUM, WEIGHTED BY NR.   FOR VGAMCALC
R0123   M' (-36+2NR)
R0124   TFP/RTMU E'(17) M'(14)   1/SQRT(MU)
R0125   TFPVSQ E'(20) M'(18) 1/M   -(V SQ/MU)' PRESENT VELOCITY,NORMALIZED.   FOR VGAMCALC
R0127   TFPALFA E' (26-NR)   1/M   ALFA, WEIGHTED BY NR
R0128   M' (24-NR)
R0129   TFPRTALF E' (10+NA)   SQRT(ALFA), NORMALIZED
R0130   M' (9+NA)

R0131			X2			-NA, NORM COUNT	
R0132			TPP1/ALP	E' (-22-2NA) SIGNED SEMI MAJ AXIS, WEIGHTED BY NA			
R0133				M' (-20-2NA)			
R0134			PUSHLOC AT PDL+0				
R0135			THE FOLLOWING IS STORED IN GENERAL ERASABLE				
R0136			VONEα E'(10) M'(9) V/RT(MU), NORMALIZED VELOCITY				
R0137	ERASABLE INITIALIZATION REQUIRED'						
R0138			RONE	E'(-29) M'(-27) M	STATE VECTOR		LEFT BY CALLER
R0140			VONE	E'(-7) M'(-5) M/CS	STATE VECTOR		LEFT BY CALLER
R0142			TPP/RTMU	E'(17) M'(14) 1/RT(CS SQ/M CUBE)			IF ENTER VIA TPPCONMU.
R0144	DEBRIS'	QPRET,	PDL+0 ... PDL+3				
R0145							

0146				33,3772		BANK	33	
0147	REP	1		27,2000		SETLOC	TOP-FF	
0148				27,2750		BANK		
0149	REP	1				COUNT*	$$/TPP	
0150	REP	5	LAST 768	27,2750	00037 0	TPPCONIC STORE	TPP/RTMU	1/SQRT(MU) E' (17) M' (14)
0151				27,2751	53575 0	TPPCONMU VLOAD	UNIT	COME HERE WITH TPPRTMU LOADED.
0152	REP	16	LAST 744	27,2752	02327 0		RONE	SAVED RN. M E' (-29) M' (-27)
0153				27,2753	77725 1		PDDL	UR/2 TO PDL+0, +5
0154				27,2754	00045 0		36D	MAGNITUDE
0155	REP	1		27,2755	00015 0	STORE	RMAG1	M E' (-29) M' (-27)
0156				27,2756	77701 1		NORM	
0157	REP	89	LAST 1310	27,2757	00047 1		X1	-NR
0158	REP	4	LAST 769	27,2760	24041 1	STOVL	NRMAG	RMAG M E' (-29+NR) M' (-27+NR)
0159	REP	11	LAST 744	27,2761	02335 0		VONE	SAVED VN. M/CS E' (-7) M' (-5)
0160				27,2762	77761 1	VXSC		
0161	REP	6	LAST 1344	27,2763	00037 0		TPP/RTMU	E' (17) M' (14)
0162	REP	2	LAST 90	27,2764	02372 0	STORE	VONEα	VN/SQRT(MU) E' (10) M' (9)
0163				27,2765	47361 0	VXSC	VXV	
0164	REP	5	LAST 1344	27,2766	00041 1		NRMAG	E' (-29+NR) M' (-27+NR)
A0165								UR/2 FROM PDL
0166				27,2767	47572 1	VSL1	VSQ	BEFORE' E'(-19+NR) M'(-18+NR)
0167	REP	2	LAST 768	27,2770	14035 1	STODL	TPPNP	LC P M E'(-38+2NR) M'(-36+2NR)
A0168								SAVE ALSO FOR VGAMCALC
0169	REP	1		27,2771	15322 0		TPP1/4	
0170				27,2772	63271 0	DDV	PDVL	(2/RMAG) 1/M E'(26-NR) M'(24-NR)
0171	REP	6	LAST 1344	27,2773	00041 1		NRMAG	RMAG M E'(-29+NR) M'(-27+NR)
0172	REP	3	LAST 1344	27,2774	02372 0		VONEα	SAVED VN. E' (10) M' (9)
0173				27,2775	57436 1	VSQ	DCOMP	KEEP MPAC+2 HONEST FOR SQRT.
0174	REP	2	LAST 768	27,2776	00025 0	STORE	TPFVSQ	-(V SQ/MU) E'(20) M'(18)
A0175								SAVE FOR VGAMCALC
0176				27,2777	43257 0	SR*	DAD	

L   TIME OF FREE FALL   USER=S PAGE NO.   5   E0 S3

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0177                        27,3000   20573 1                    0 -6,1        GET -VSQ/MU    E'(26-NR)   M'(24-NR)
0178                        27,3001   77626 0          STADR
A0179                                                                2/RMAG   FROM PDL+2
0180   REF   1              27,3002   77744 0          STORE  TFFALFA    ALFA  1/M   E'(26-NR)   M'(24-NR)
0181                        27,3003   41457 1          SL*    PUSH       TEMP SAVE ALFA      E'(20)    M'(18)
0182                        27,3004   20173 0                  0 -6,1
0183                        27,3005   75446 0          ABS    SQRT       E'(10)   M'(9)
0184                        27,3006   77701 1          NORM
0185   REF  39  LAST 1336   27,3007   00050 1                 X2         X2 = -NA
0186   REF   1              27,3010   00031 0          STORE  TFFRTALF   SQRT( ABS(ALFA) )  E'(10+NA)   M'(9+NA)
0187                        27,3011   75316 1          DSQ    SIGN       NOT SO ACCURATE, BUT OK
A0188                                                                ALFA FROM PDL+2   E'(20)   M'(18)
0189                        27,3012   55254 1          BZE    BDDV       SET 1/ALFA =0, TO SHOW SMALL ALFA
0190                        27,3013   57015 1                 +2
0191   REF   2  LAST 1344   27,3014   15322 0                 TFF1/4
0192   REF   1              27,3015   00027 1    +2    STORE  TFF1/ALF   1/ALFA   E'(-22-2 NA)   M'(-20-2 NA)
0193                        27,3016   77616 0    DUMPCNIC RVQ

A0194                                                                                        39 W
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L   TIME OF FREE FALL   USER=S PAGE NO.   6   E0 53

P0195   SUBROUTINE NAME'   TFFRP/RA   DATE' 01.17.67
R0197   MOD NO' 0   LOG SECTION'   TIME OF FREE FALL
R0199   MOD BY' RR BAIRNSFATHER
R0200   MOD NO' 1   MOD BY' RR BAIRNSFATHER   DATE' 11 APR 67
R0201   MOD NO' 2   MOD BY' RR BAIRNSFATHER   DATE' 21 MAR 68   ACCEPT DIFFERENT EARTH/MOON SCALES
R0203   ALSO IMPROVE ACCURACY OF RAPO.
R0205   FUNCTIONAL DESCRIPTION'   USED BY CALCTPER AND TFF DISPLAYS TO CALCULATE PERIGEE RADIUS AND ALSO
R0207   APOGEE RADIUS FOR A GENERAL CONIC.
R0208   PROGRAM GIVES PERIGEE RADIUS AS   APOGEE RADIUS IS GIVEN BY
R0210   RP = P /(1+E)   RA = (1+E) / ALFA
R0212   WHERE   2
R0213   E = 1 - P ALFA
R0214   IF RA IS NEGATIVE OR SHOWS DIVIDE OVERFLOW, THEN RA = POSMAX BECAUSE
R0216   1. APOGEE RADIUS IS NOT MEANINGFUL FOR HYPERBOLA
R0217   2. APOGEE RADIUS IS NOT DEFINED FOR PARABOLA
R0218   3. APOGEE RADIUS EXCEEDS THE SCALING FOR ELLIPSE.
R0219   THIS SUBROUTINE REQUIRES THE SIGNED RECIPROCAL SEMI MAJ AXIS, ALFA, AND SEMI LATUS RECTUM AS DATA.
R0221   CALLING SEQUENCE'   CALL
R0222   TFFRP/RA
R0223   PUSHLOC = PDL+0, ARBITRARY IF LEQ 10D
R0224   C(MPAC) UNSPECIFIED

R0225   SUBROUTINES CALLED'   NONE
R0228   NORMAL EXIT MODE'   RVQ
R0227   IF ELLIPSE, WITHIN NORMAL SCALING, RAPO IS CORRECT.
R0228   OTHERWISE, RAPO = POSMAX.
R0229   ALARMS'   NONE
R0230   OUTPUT'   STORED IN PUSH LIST AREA. SCALE OF OUTPUT AGREES WITH DATA SUPPLIED TO TFF/CONIC.
R0232   RPER   E'(-29) M'(-27) M   PERIGEE RADIUS   DESTROYED BY CALCTFF/CALCTPER, TFFTRIG.
R0234   RAPO   E'(-29) M'(-27) M   APOGEE RADIUS   WILL BE DESTROYED BY CALCTFF/CALCTPER
R0238   PUSHLOC AT PDL+0
R0237   ERASABLE INITIALIZATION REQUIRED'
R0238   TFFALFA E'(26-NR)   M   1/SEMI MAJ AXIS   LEFT BY TFFCONIC
R0240   M'(24-NR)
R0241   TFFNP   E' (-38+2NR)   M LC P, SEMI LATUS RECTUM   LEFT BY TFFCONIC
R0243   M' (-36+2NR)
R0244   X1   -NR, NORM COUNT OF RMAG   LEFT BY TFFCONIC
R0248   X2   -NA, NORM COUNT OF ALFA   LEFT BY TFFCONIC
R0248   DEBRIS'   QPRET,   PDL+0 ... PDL+1

P0249								
0250				0020		RAPO	=	16D	APOGEE RADIUS M E'(-29) M'(-27)
0251				0016		RPER	=	14D	PERIGEE RADIUS M E'(-29) M'(-27)
A0252								
0253				27,3017	41345 0	TFFRP/RA	DLOAD	DMP	
0254	REF	2	LAST 1345	27,3020	00033 1			TFFALPA	ALPA 1/M E'(26-NR) M'(24-NR)
0255	REF	3	LAST 1344	27,3021	00035 1			TFFNP	LC P M E'(-38+2NR) M'(-36+2NR)
0256				27,3022	57457 0		SR*	DCOMP	ALPA P (-12+NR)
0257				27,3023	20571 0			0 -8D,1	ALPA P (-4)
0258				27,3024	51415 0		DAD	ABS	(DCOMP GIVES VALID TP RESULT FOR SQRT)
A0259									(ABS PROTECTS SQRT IF E IS VERY NEAR 0)
0260	REF	4	LAST 833	27,3025	17357 0			DP2(-4)	
0261				27,3026	43386 0		SQRT	DAD	E SQ = (1- P ALPA) (-4)
0262	REF	3	LAST 1345	27,3027	15322 0			TFF1/4	
0263				27,3030	55206 0		PUSH	BDDV	(1+E) (-2) TO PDL+0
0264	REF	4	LAST 1347	27,3031	00035 1			TFFNP	LCP M E'(-38+2NR) M'(-36+2NR)
0265				27,3032	53857 0		SR*	SR*	(DOES SR THEN SL TO AVOID OVFL)
0266				27,3033	20601 1			0,1	X1=-NR
0267				27,3034	20572 0			0 -7,1	(EFFECTIVE SL)
0268	REF	3	LAST 514	27,3035	14017 1		STODL	RPER	PERIGEE RADIUS M E'(-29) M'(-27)
A0269									(1+E) (-2) FROM PDL+0
0270				27,3036	41005 1		DMP	BOVB	
0271	REF	2	LAST 1345	27,3037	00027 1			TFF1/ALP	E'(-22-2NA) M'(-20-2NA)
0272	REF	11	LAST 1303	27,3040	57343 1			TCDANZIG	CLEAR OVFIND, IF ON.
0273				27,3041	53854 0		BZE	SL*	
0274	REF	1		27,3042	57051 1			MAXRA	SET POSMAX, IF ALPA=0
0275				27,3043	57603 0			0 -5,2	-5+NA
0276				27,3044	40057 1		SL*	BOV	
0277				27,3045	57576 1			0,2	
0278	REF	2	LAST 1347	27,3046	57051 1			MAXRA	SET POSMAX IF OVFL.
0279				27,3047	77644 1			BPL	CONTINUE WITH VALID RAPO.
0280				27,3050	57053 0			+3	
0281				27,3051	77745 1	MAXRA	DLOAD		RAPO CALC IS NOT VALID. SET RAPO =
0282	REF	4	LAST 833	27,3052	17383 1			NEARONE	POSMAX AS A TAG.
0283	REF	1		27,3053	00021 1	+3	STORE	RAPO	APOGEE RADIUS M E'(-29) M'(-27)
0284				27,3054	77616 0	DUMPRPRA	RVQ		

A0285   30 W

L   TIME OF FREE FALL   USER=S PAGE NO.   8   E0 53

P0286   SUBROUTINE NAME'   CALCTPER / CALCTFF   DATE'   01.29.67
R0288   MOD NO' 0   LOG SECTION'   TIME OF FREE FALL
R0290   MOD BY' RR BAIRNSFATHER
R0291   MOD NO' 1   MOD BY' RR BAIRNSFATHER   DATE' 21 MAR 67
R0292   MOD NO' 2   MOD BY' RR BAIRNSFATHER   DATE' 14 APR 67
R0293   MOD NO' 3   MOD BY' RR BAIRNSFATHER   DATE' 8JUL 67   NEAR EARTH MUE AND NEG TFF (GONEPAST)
R0295   MOD NO' 4   MOD BY' RR BAIRNSFATHER   DATE' 21 NOV 67   ADD VARIABLE MU.
R0297   MOD NO' 5   MOD BY' RR BAIRNSFATHER   DATE' 21 MAR 68   ACCEPT DIFFERENT EARTH/MOON SCALES
R0299   FUNCTIONAL DESCRIPTION'   PROGRAM CALCULATES THE FREE-FALL TIME OF FLIGHT FROM PRESENT POSITION RN AND
R0301   VELOCITY VN TO A RADIUS LENGTH SPECIFIED BY RTERM , SUPPLIED BY THE USER. THE POSITION VECTOR
R0303   RN MAY BE ON EITHER SIDE OF THE CONIC, BUT RTERM IS CONSIDERED ON THE INBOUND SIDE.
R0305   THE EQUATIONS ARE

R0306   Q2 = -SQRT(RTERM (2-RTERM ALFA) - LCP)   (INBOUND SIDE))   LEO +- LCE/SQRT(ALFA)
R0308
R0309   Q1 = RN.VN / SQRT(MU)   LEO +- LCE/SQRT(ALFA)

R0311   Z = NUM / DEN   LEO +- 1/SQRT(ALFA)

R0313   WHERE, IF INBOUND
R0314   NUM = RTERM - RN   LEO +- 2 LCE/ALFA
R0316   DEN = Q2+Q1   LEO +- 2 LCE/SQRT(ALFA)

R0318   AND, IF OUTBOUND
R0319   NUM = Q2-Q1   LEO +- 2 LCE/SQRT(ALFA)
R0321   DEN = 2 - ALFA (RTERM + RN)   LEO +- 2 LCE

R0323   IF   ALFA ZZ ± 1.0   (FOR ALL CONICS EXCEPT ELLIPSES HAVING ABS(DEL ECC ANOM) G 90 DEG)

R0325   THEN X = ALFA Z Z
R0326   AND   TFF = (RTERM +RN -2 ZZ T(X)) Z/SQRT(MU)

R0327   EXCEPT IF ALFA PNZ, AND IF TFF NEG,
R0328   THEN   TFF = 2 PI /(ALFA SQRT(ALFA)) + TFF

R0329   OR IF ALFA ZZ GEO 1.0   (FOR ELLIPSES HAVING ABS(DEL ECC ANOM) GEO 90 DEG)

R0331   THEN   X = 1/ALFA Z Z
R0332   AND   TFF = (PI/SQRT(ALFA) -Q2 +Q1 +2(X T(X) -1) /ALFA Z) /ALFA SQRT(MU)

R0334   WHERE T(X) IS A POLYNOMIAL APPROXIMATION TO THE SERIES
R0335   2   3   2
R0336   1/3 -X/5 +X /7 -X /9 ...   (X ± 1.0)

R0337   CALLING SEQUENCE' TIME TO RTERM   TIME TO PERIGEE
R0339   CALL   CALL
R0340   CALCTFF   CALCTPER
R0342   C(MPAC) = TERMNL RAD M   C(MPAC) = PERIGEE RAD M
R0344   FOR EITHER,   E' (-29)   M' (-27)
R0345   FOR EITHER, PUSHLOC = PDL+0 , ARBITRARY IF LEO 8D.

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R0346     SUBROUTINES CALLED'  T(X),  VIA RTB
R0347     NORMAL EXIT MODE'  RVQ
R0348           HOWEVER, PROGRAM EXITS WITH ONE OF THE FOLLOWING VALUES FOR TFF (-28) CS  IN MPAC. USER MUST STORE.
R0350               A.  TFF= FLIGHT TIME. NORMAL CASE FOR POSITIVE FLIGHT TIME LESS THAN ONE ORBITAL PERIOD.
R0352               B.  (THIS OPTION IS NO LONGER USED.)
R0353               C.  TFF = POSMAX.  THIS INDICATES THAT THE CONIC FROM THE PRESENT POSITION WILL NOT RETURN TO
R0355                   THE SPECIFIED ALTITUDE.  ALSO INDICATES OUTBOUND PARABOLA OR HYPERBOLA.
R0357     OUTPUT'  C(MPAC)  (-28) CS    TIME OF FLIGHT, OR TIME TO PERIGEE
R0358          TFFX   (0)            X,                              LEFT FOR ENTRY DISPLAY TFF ROUTINES
R0360          NRTERM  E' (-29+NR)   M  RTERM, WEIGHTED BY NR        LEFT FOR ENTRY DISPLAY TFF ROUTINES
R0362                  M' (-27+NR)
R0363          TFFTEM  E' (-59+2NR)  LCP Z Z SGN(SDELF)             LEFT FOR ENTRY DISPLAY TFF ROUTINES
R0365                  M' (-55+2NR)  LCP /ALFA SGN(SDELF)           LEFT FOR ENTRY DISPLAY TFF ROUTINES
R0367     NOTE'  TFFTEM = PDL 38D AND WILL BE DESTROYED BY .'UNIT'.
R0368          RMAG1   E'(-29)  M'(-27)  PDL 12 NOT TOUCHED.
R0369          TFFQ1   E'(-16)  M'(-15)  PDL 14D
R0370          TFFDELQ E'(-16)  M'(-15)  PDL 10D
R0371          PUSHLOC AT PDL+0
R0372     ERASABLE INITIALIZATION REQUIRED'
R0373          RONE    E'(-29)  M'(-27)  M   STATE VECTOR            LEFT BY USER
R0375          VONE=   E'(+10)  M'(+9)   VN/SQRT(MU)                 LEFT BY TFF/CONIC
R0377          RMAG1   E'(-29)  M'(-27)  PRESENT RADIUS, M           LEFT BY TFFCONIC
R0379          C(MPAC) E'(-29)  M'(-27)  RTERM, TERMINAL RADIUS LENGTH, M   LEFT BY USER

R0381          THE FOLLOWING ARE STORED IN THE PUSH LIST AREA.
R0382          TFF/RTMU E'(17)  M'(14)   1/SQRT(MU)                  LEFT BY TFFCONIC.
R0384          NRMAG   E' (-29+NR)  M  RMAG, NORMALIZED              LEFT BY TFFCONIC
R0386                  M' (-27+NR)
R0387          X1                        -NR, NORM COUNT             LEFT BY TFFCONIC
R0389          TFFNP   E' (-38+2NR)  M  LCP, SEMI LATUS RECTUM, WEIGHT NR   LEFT BY TFFCONIC
R0391                  M' (-36+2NR)
R0392          TFFALFA E' (26-NR)      1/M  ALFA, WEIGHT  NR         LEFT BY TFFCONIC
R0394                  M' (24-NR)
R0395          TFFRTALF E'(10+NA)      SQRT(ALFA), NORMALIZED        LEFT BY TFFCONIC
R0397                  M'(9+NA)
R0398          X2                        -NA, NORM COUNT             LEFT BY TFFCONIC
R0400          TFF1/ALF E' (-22-2NA)   SIGNED SEMIMAJ AXIS, WEIGHTED BY NA   LEFT BY TFFCONIC
R0402                  M' (-20-2NA)
R0403     DEBRIS'  QPRET,  PDL+0 ... PDL+3
R0404          RTERM  E'(-29)  M'(-27)  RTERM, TERMINAL RADIUS LENGTH
R0405          RAPO   E'(-29)  M'(-27)  PDL 16D  (=NRTERM)
R0406          RPER   E'(-29)  M'(-27)  PDL 14D   (=TFFQ1)
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P0407									
0408				27,3055	77614 1	CALCTPER	SETGO		ENTER WITH RPER IN MPAC
0409	REP	1		27,3056	03436 0			TPFSW	
0410				27,3057	57062 1			+3	
0411				27,3060	77614 1	CALCTFP	CLEAR		ENTER WITH RTERM IN MPAC
0412	REP	2	LAST 1350	27,3061	03676 0			TPFSW	
0413	REP	3	LAST 764	27,3062	00023 0	+3	STORE	RTERM	E' (-29) M' (-27)
0414				27,3063	77657 0		SL*		
0415				27,3064	20201 0			0,1	X1=-NR
0416	REP	6	LAST 769	27,3065	00021 1		STORE	NRTERM	RTERM E' (-29+NR) M' (-27+NR)
0417				27,3066	44205 0		DMP	BDSU	
0418	REP	3	LAST 1347	27,3067	00033 1			TPFALFA	ALFA E' (26-NR) M' (24-NR)
0419	REP	4	LAST 1347	27,3070	15322 0			TPP1/4	
0420				27,3071	41206 0		PUSH	DMP	(2-ALFA RTERM) (-3) TO PDL+0
0421	REP	7	LAST 1350	27,3072	00021 1			NRTERM	E' (-29+NR) M' (-27+NR)
0422				27,3073	53725 1		PDDL	SR*	RTERM(2-ALFA RTERM) TO PDL+2
A0423									E' (-32+NR) M' (-30+NR)
0424	REP	5	LAST 1347	27,3074	00035 1			TPPNP	LC P E'(-38+2NR) M'(-36+2NR)
0425				27,3075	20573 1			0 -6,:	X1 = -NR
0426				27,3076	43276 0		DCOMP	DAD	DUE TO SHIFTS, KEEP PRECISION FOR SQRT
A0427									RTERM(2-ALFA RTERM) FROM PDL+2
A0428									E' (-32+NR) M' (-30+NR)
0429				27,3077	77657 0		SR*		LEAVE E' (-32) M' (-30)
0430				27,3100	20601 1			0,1	X1 = -NR
0431				27,3101	71214 0		BOFF	DLOAD	CHECK TPP / TPER SWITCH
0432	REP	3	LAST 1350	27,3102	03756 0			TPFSW	
0433				27,3103	57105 1			+2	IF TPP, CONTINUE
0434	REP	1		27,3104	15332 1			TPFZEROS	IF TPER, SET O2 = 0
0435				27,3105	75440 0	+2	BMN	SQRT	E' (-16) M' (-15)
0436	REP	1		27,3106	57240 0			MAXTPP1	NO FREE FALL CONIC TO RTERM FROM HERE
A0437									RESET PDL, SET TPP=POSMAX, AND EXIT.
0438				27,3107	41076 0		DCOMP	BOVB	RT IS ON INBOUND SIDE. ASSURE OVPIND=0
0439	REP	12	LAST 1347	27,3110	57343 1			TCDANZIG	ANY PORT IN A STORM.
0440	REP	3	LAST 770	27,3111	24045 0		STOVL	TPPTEM	O2 E' (-16) M' (-15)
0441	REP	4	LAST 1344	27,3112	02372 0			VONE∝	VN/SQRT(MU) E' (10) M' (9)
0442				27,3113	52441 1		DOT	SL-3	
0443	REP	17	LAST 1344	27,3114	02327 0			RONE	SAVED RN. E' (-29) M' (-27)
0444	REP	1		27,3115	00017 1		STORE	TPPO1	O1, SAVE FOR GONEPAST TEST.
A0445									E' (-16) M' (-15)
0446				27,3116	44240 1		BMN	BDSU	
0447	REP	1		27,3117	57140 0			INBOUND	USE ALTERNATE Z
0448	REP	4	LAST 1350	27,3120	00045 0			TPPTEM	O2 E' (-16) M' (-15)
A0449					OUTBOUND Z CALC CONTINUES HERE					
0450	REP	2	LAST 769	27,3121	14043 0		STODL	TPPX	NUM=O2-O1 E' (-16) M' (-15)
0451	REP	4	LAST 1350	27,3122	00033 1			TPFALFA	ALFA E' (26-NR) M' (24-NR)
0452				27,3123	44205 0		DMP	BDSU	

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0453	REF	7	LAST 1344	27,3124	00041 1			NRMAG	RMAG E' (-29+NR) M' (-27+NR)
A0454									(2-RTERM ALFA) (-3) FROM PDL+0
0455	.			27,3125	51406 1	SAVEDEN	PUSH	ABS	DEN TO PDL+0 E' (-3) OR (-16)
A0456									M' (-3) OR (-15)
0457				27,3126	40015 1		DAD	BOV	INDETERMINANCY TEST
0458	REF	1		27,3127	17351 0			LIM(-22)	=1.0-B(-22)
0459	REF	1		27,3130	57151 0			TFFXTEST	GO IF DEN δ/= B(-22)
0460	.			27,3131	65345 0	.	DLOAD	PDDL	SET DEN=0 OTHERWISE
0461	REF	2	LAST 1350	27,3132	15332 1			TFFZEROS	
A0462									XCH ZERO WITH PDL+0
0463	.			27,3133	57545 1		DLOAD	DCOMP	
0464	REF	5	LAST 1350	27,3134	00033 1			TFFALFA	ALFA E' (26-NR) M' (24-NR)
0465				27,3135	71240 1		BMN	DLOAD	FOR TPER' Z INDET AT DELE/2=0 AND 90.
0466	REF	1		27,3136	57245 0			TFFEL1 .	ASSUME 90, AND LEAVE 0 IN PDL' 1/Z=D/N
A0467									Z INDET. AT PERIGEE FOR PARAB OR HYPERB.
0468				27,3137	77616 0	DUMPTFF1	RVQ		RETURN TFF =0
A0469						INBOUND	Z	CALC CONTINUES HERE	
0470				27,3140	77745 1	INBOUND	DLOAD		RESET PDL+0
0471				27,3141	45345 1		DLOAD	DSU	ALTERNATE Z CALC
0472	REF	4	LAST 1350	27,3142	00023 0			RTERM	E' (-29) M' (-27)
0473	REF	2	LAST 1344	27,3143	00015 0			RMAG1	E' (-29) M' (-27)
0474	REF	3	LAST 1350	27,3144	14043 0	STODL		TFFX	NUM=RTERM-RN E' (-29) M' (-27)
0475	REF	5	LAST 1350	27,3145	00045 0	.		TFFTEM	Q2 E' (-18) M' (-15)
0476	.			27,3146	52015 1		DAD	GOTO	
0477	REF	2	LAST 1350	27,3147	00017 1			TFFQ1	Q1 E' (-16) M' (-15)
0478	REF	1		27,3150	57125 0			SAVEDEN	DEN = Q2+Q1 E' (-16) M' (-15)
0479				27,3151	65215 1	TFFXTEST	DAD	PDDL	(ABS(DEN) TO PDL+2) E' (-3) OR (-16)
A0480									M' (-3) OR (-15)
0481	REF	1		27,3152	17353 1			DP(-22)	RESTORE ABS(DEN) TO MPAC
0482	REF	4	LAST 1351	27,3153	00043 0			TFFX	NUM E'(-18) OR (-29) M'(-15) OR (-27)
0483				27,3154	53605 1		DMP	SR*	
0484	REF	2	LAST 1345	27,3155	00031 0			TFFRTALF	SQRT(ALFA) E' (10+NA) M' (9+NA)
0485				27,3156	57201 0			0 -3,2	X2=-NA
0486				27,3157	77671 1		DDV		C(MPAC) =NUM SQRT(ALFA) E'(-3) OR (-18)
A0487									M'(-3) OR (-15)
A0488									ABS(DEN) FROM PDL+2 E'(-3) OR (-16)
A0489									M'(-3) OR (-15)
0490				27,3160	40145 0		DLOAD	BOV	(THE DLOAD IS SHARED WITH TFFEL1)
0491	REF	5	LAST 1351	27,3161	00043 0			TFFX	NUM E' (-16) OR (-29) M'(-15) OR (-27)
0492	REF	1		27,3162	57243 0			TFFELL	USE EQN FOR DELE GEO 90, LEO -90
A0493						OTHERWISE,	CONTINUE FOR GENERAL CONIC FOR TFF EQN		
0494				27,3163	45471 1		DDV	STADR	DEN FROM PDL+0 E' (-3) OR (-18)
A0495									M' (-3) OR (-15)
A0496									
. 0497	REF	6	LAST 1351	27,3164	77732 1		STORE	TFFTEM	Z SAVE FOR SIGN OF SDELF.

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A0498								E' (-13) M' (-12)
0499				27,3165	63406 0		PUSH	DSQ	Z TO PDL+0
0500				27,3166	41206 0		PUSH	DMP	Z SQ TO PDL+2 E' (-26) M' (-24)
0501	REF	6	LAST 1350	27,3167	00035 1			TPFNP	LC P E' (-38+2NR) M' (-38+2NR)
0502				27,3170	75261 0		SL	SIGN	
0503				27,3171	20206 1			5	
0504	REF	7	LAST 1351	27,3172	00045 0			TPFTEM	APPIX SIGN FOR SDELF (ENTRY DISPLAY)
0505	REF	6	LAST 1352	27,3173	14045 0		STODL	TPFTEM	P ZSQ E' (-59+2NR) M' (-55+2NR)
A0506									(ARG IS USED IN TPF/TRIG)
A0507									ZSQ FROM PDL+2 E' (-26) M' (-24)
0508				27,3174	41206 0		PUSH	DMP	RESTORE PUSH LOC
0509	REF	6	LAST 1351	27,3175	00033 1			TPFALPA	ALFA E' (26-NR) M' (24-NR)
0510				27,3176	77657 0		SL*		
0511				27,3177	20201 0			0,1	X1=-NR
0512	REF	6	LAST 1351	27,3200	00043 0		STORE	TPFX	X
0513				27,3201	41234 1		RTB	DMP	
0514	REF	1		27,3202	57325 1			T(X)	POLY
A0515									ZSQ FROM PDL+2 E' (-26) M' (-24)
0516				27,3203	44302 0		SR2	BDSU	2 ZSQ T(X) E' (-29) M' (-27)
0517	REF	5	LAST 1351	27,3204	00023 0			RTERM	RTERM E' (-29) M' (-27)
0518				27,3205	41215 1		DAD	DMP	
0519	REF	3	LAST 1351	27,3206	00015 0			RMAG1	E' (-29) M' (-27)
A0520									Z FROM PDL+0 E' (-13) M' (-12)
0521				27,3207	51042 0		SR3	BPL	TPF SQRT(MU) E' (-45) M' (-42)
0522	REF	1		27,3210	57231 0			ENDTPF	(NO PUSH UP)
0523				27,3211	75206 1		PUSH	SIGN	TPF SQRT(MU) TO PDL+0
0524	REF	3	LAST 1351	27,3212	00017 1			TPFQ1	Q1 FOR GONEPAST TEST
0525				27,3213	71244 0		BPL	DLOAD	GONE PAST π
0526	REF	1		27,3214	57235 1			NEGTPF	YES. TPF ± 0 .
0527	REF	3	LAST 1347	27,3215	00027 1			TPF1/ALF	1/ALFA E' (-22-2NA) M' (-20-2NA)
0528				27,3216	51076 1		DCOMP	BPL	ALFA δ 0 π
0529	REF	2	LAST 1352	27,3217	57235 1			NEGTPF	NO. TPF IS NEGATIVE.

CORRECT FOR ORBITAL PERIOD.

A0530									
0531				27,3220	77676 0		DCOMP		YES. CORRECT FOR ORB PERIOD.
0532				27,3221	56205 0		DMP	DDV	
0533	REF	1		27,3222	17347 1			PI/16	2 PI (-5)
0534	REF	3	LAST 1351	27,3223	00031 0			TPFRTALF	SQRT(ALFA) E' (10+NA) M' (9+NA)
0535				27,3224	53657 0		SL*	SL*	
0536				27,3225	57602 1			0 -4,2	X2=-NA
0537				27,3226	57602 1			0 -4,2	
0538				27,3227	43257 0		SL*	DAD	
0539				27,3230	57576 1			0,2	
A0540									TPF SQRT(MU) FROM PDL+0 E'(-45) M'(-42)
0541				27,3231	40005 0	ENDTPF	DMP	BOV	TPF SQRT(MU) IN MPAC E'(-45) M'(-42)
0542	REF	7	LAST 1344	27,3232	00037 0			TPF/RTMU	E' (17) M' (14)
0543	REF	1		27,3233	57241 1			MAXTPF	SET POSMAX IF OVFL.
0544				27,3234	77616 0	DUMPTPF2 RVQ			RETURN TPF (-28) CS IN MPAC.

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0545				27,3235	77745 1	NEGTPP	DLOAD
A0546						
0547				27,3236	77650 1		GOTO
0548	REF	2	LAST 1352	27,3237	57231 0		ENDTPP

TPP SQRT(MU) FROM PDL+0, NEGATIVE.

0549				27,3240	77745 1	MAXTPP1	DLOAD
0550				27,3241	43545 1	MAXTPP	DLOAD RVQ
0551	REF	5	LAST 1347	27,3242	17363 1		NEARONE

RESET PDL

R0552   TIME OF FLIGHT ELLIPSE WHEN DEL (ECCENTRIC ANOM) GEQ 90 AND LEQ -90.

NUM FROM TPFX. E' (-16) OR (-29)
                M' (-15) OR (-27)

A0553							
A0554							
0555				27,3243	77712 0	TPFELL	SL2
0556				27,3244	41465 0		BDDV PUSH
A0557							
A0558							
0559				27,3245	45345 1	TPFEL1	DLOAD DSU
0560	REF	9	LAST 1352	27,3246	00045 0		TPPTEM
0561	REF	4	LAST 1352	27,3247	00017 1		TPFQ1
0562	REF	1		27,3250	14013 0		STODL TPFDELO
A0563							
0564				27,3251	77626 0		STADR
0565	REF	10	LAST 1353	27,3252	77732 1		STORE TPFTEM
0566				27,3253	53605 1		DMP SL*
0567	REF	4	LAST 1352	27,3254	00027 1		TPFQ1/ALP
0568				27,3255	57576 1		0,2
0569				27,3256	41206 0		PUSH DMP
0570	REF	11	LAST 1353	27,3257	00045 0		TPFTEM
0571				27,3260	41057 0		SL* BOVB
0572				27,3261	57576 1		0,2
0573	REF	16	LAST 1293	27,3262	45707 0		SIGNMPAC
0574	REF	7	LAST 1352	27,3263	00043 0		STORE TPFX
0575				27,3264	41234 1		RTB DMP
0576	REF	2	LAST 1352	27,3265	57325 1		T(X)
0577	REF	8	LAST 1353	27,3266	00043 0		TPFX
0578				27,3267	45242 1		SR3 DSU
0579	REF	1		27,3270	17355 1		DP2(-3)
0580				27,3271	41405 0		DMP PUSH

NUM E'(-14) OR (-27) M'(-13) OR (-25)
TEMP SAVE D/N IN PDL+0
DEN FROM PDL+0 E'(-3)/(16) M'(-3)/(-15)
N/D TO PDL+0 E' (-11) M' (-10)
(ENTER WITH D/N=0 IN PDL+0)
Q2 E' (-16) M' (-15)
Q1 E' (-16) M' (-15)
Q2-Q1 E' (-16) M' (-15)
D/N FROM PDL+0

D/N E' (-11) M' (-10)

1/ALFA E' (-22-2NA) M' (-20-2NA)
1/ALFA Z E' (-11-NA) M' (-10-NA)
TO PDL+0
1/Z E' (-11) M' (-10)

X2= -NA
IN CASE X= 1.0, CONTINUE
X=1/ALFA ZSQ

POLY.

2(X T(X)-1) /Z ALFA E' (-15-NA)
                     M' (-14-NA)
1/ALFA Z FROM PDL+0 E' (-11-NA)
                     M' (-10-NA)

A0581							
A0582							
A0583							
0584				27,3272	41345 0		DLOAD DMP
0585	REF	12	LAST 1353	27,3273	00045 0		TPFTEM
0586	REF	4	LAST 1352	27,3274	00015 0		RMAG1
0587				27,3275	43312 0		SL2 DAD
0588	REF	5	LAST 1353	27,3276	00017 1		TPFQ1
0589	REF	13	LAST 1353	27,3277	14045 0		STODL TPFTEM
0590	REF	7	LAST 1352	27,3300	00035 1		TPFNP
0591				27,3301	53805 1		DMP SL*

GET SIGN FOR SDELF
1/Z E' (11) M' (10)
E' (-29) M' (-27)

Q1 E' (-16) M' (-15)
(Q1+R 1/Z) =SGN OF SDELF E'(-16) M'(-15
LC P E' (-38+2NR) M' (-36+2NR)
CALC FOR ARG FOR TPF/TRIG.

L   TIME OF FREE FALL

0592	RSP	5	LAST 1353	27,3302	00027 1		TFP1/ALP	1/ALPA E'(-22-2NA) M'(-20-2NA)
0593				27,3303	57575 1		1,2	X2=-NA
0594				27,3304	53785 0	SIGN	SL*	
0595	RSP	14	LAST 1353	27,3305	00045 0		TFPTEM	AFFIX SIGN FOR SDELF
0596				27,3306	57576 1		0,2	
0597	REP	15	LAST 1354	27,3307	14045 0	STODL	TFPTEM	P/ALPA E'(-59+2NR) M'(-55+2NR)
A0598								(ARG FOR USE IN TFP/TRIG)
0599	REP	6	LAST 1354	27,3310	00027 1		TFP1/ALP	1/ALPA E'(-22-2NA) M'(-20-2NA)
0600				27,3311	41366 1	SQRT	DMP	
0601	REP	2	LAST 1352	27,3312	17347 1		PI/16	
0602				27,3313	77615 0	DAD		PI (-4)
A0603								
A0604								2(XT(X)-1)/Z ALPA FROM PDL E'(-15-NA)
0605								M'(-14-NA)
0606				27,3314	45257 0	SL*	DSU	
0607	REP	2	LAST 1353	27,3315	57577 0		0 -1,2	Q2-Q1 E' (-16) M' (-15)
0608				27,3316	00013 0		TFFDELO	
0609	REP	7	LAST 1354	27,3317	53805 1	DMP	SL*	
0610				27,3320	00027 1		TFP1/ALP	1/ALPA E'(-22-2NA) M'(-20-2NA)
0611				27,3321	57601 1		0 -3,2	
0612				27,3322	52057 1	SL*	GOTO	
0613	REP	3	LAST 1353	27,3323	57602 1		0 -4,2	
				27,3324	57231 0		ENDTFP	TFP SQRT(MU) IN MPAC E'(-45) M'(-42)

L   TIME OF FREE FALL   USER»S PAGE NO.   15   E0 S3

P0614   PROGRAM NAME'   T(X)
R0616   MOD NO'   0   DATE'   01.17.67
R0618   MOD BY'   RR BAIRNSFATHER   LOG SECTION'   TIME OF FREE FALL
R0619   FUNCTIONAL DESCRIPTION'   THE POLYNOMIAL T(X) IS USED BY TIME OF FLIGHT SUBROUTINES CALCTFF AND
R0621   CALCTPER TO APPROXIMATE THE SERIES
R0622   2   3
R0623 $1/3 -X/5 +X/7 -X/9 ...$

R0624   WHERE   X = ALFA Z Z   IF ALFA Z Z LEQ 1
R0625   X = 1/(ALFA Z Z) IF ALFA Z Z   G 1

R0626   ALSO   X IS NEG FOR HYPERBOLIC ORBITS
R0627   X = 0 FOR PARABOLIC ORBITS
R0628   X IS POSITIVE FOR ELLIPTIC ORBITS
R0629   FOR FLIGHT 278, THE POLYNOMIAL T(X) IS FITTED OVER THE RANGE (0,+1) AND HAS A MAXIMUM
R0631   DEVIATION FROM THE SERIES OF 2 E-5   (T(X) IS A CHEBYCHEV TYPE FIT AND WAS OBTAINED USING
R0633   MAC PROGRAM AUTCURFIT294RRB AND IS VALID TO THE SAME TOLERANCE OVER THE RANGE (-.08,+1).)
R0635   CALLING SEQUENCE'   RTB
R0636   T(X)
R0637   C(MPAC) = X

R0638   SUBROUTINES CALLED'   NONE
R0639   NORMAL EXIT MODE'   TC   DANZIG
R0640   ALARMS'   NONE
R0641   OUTPUT'   C(MPAC) = T(X)
R0642   ERASABLE INITIALIZATION REQUIRED'
R0643   C(MPAC) = X
R0644   DEBRIS'   NONE

0645	REP	10	LAST 1264	27,3325	0 7171 1	T(X)	TC	POLY
0646				27,3326	00004 0		DEC	4
0647				27,3327	12525 0		2DEC	3.333333333 E-1
0647				27,3330	12525 0			
0648				27,3331	71463 0		2DEC*	-1.999819135 E-1 *
0648				27,3332	57703 1			
0649				27,3333	04423 0		2DEC*	1.418148467 E-1 *
0649				27,3334	17645 0			
0650				27,3335	74604 0		2DEC*	-1.01310997 E-1 *
0650				27,3336	43667 1			
0651				27,3337	01626 1		2DEC*	5.609004986 E-2 *
0651				27,3340	37256 1			
0652				27,3341	77404 1		2DEC*	-1.536156925 E-2 *
0652				27,3342	52071 0			
0653	REP	67	LAST 1286	27,3343	0 6030 1	ENDT(X)	TC	DANZIG

0654	REP	1		27,3343		TCDANZIG =	ENDT(X)

The $N-1$ notation appears to the right of the DEC 4 line.

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P0655   TFF CONSTANTS
0656   32,3755   BANK   32

0657   REF   1   27,2000   SETLOC TOP-FF1
0658   27,3344   BANK

A0659   NOTE   NOTE   ADJUSTED MUE FOR NEAR EARTH TRAJ.

A0000   MUE   =   3.990 815 471 E10 M CUBE/CS SQ
A0001   RTMUE   =   1.997702549 E5 B-18*   MODIFIED EARTH MU

0602   27,3344   24775 1 1/RTMU   2DEC*   .5005750271 E-5 B17*   MODIFIED EARTH MU
0662   27,3345   30424 0
A0003   NOTE   NOTE   ADJUSTED MUE FOR NEAR EARTH TRAJ.

A0664   MUM   =   4.902 778 E8   M CUBE /CS SQ

A0005   RTMUM   2DEC*   2.21422178 E4 B-18*
0600   27,3340   06220 1 PI/10   2DEC   3.141592653 B-4
0666   27,3347   37553 0
0667   27,3350   37777 1 LIM(-22) 2OCT   37777 37700   1.0 -B(-22)
0667   27,3351   37700 1
0668   27,3352   00000 1 DP(-22) 2OCT   00000 00100   B(-22)
0608   27,3353   00100 0
0609   27,3354   04000 0 DP2(-3) 2DEC   1 B-3
0669   27,3355   00000 1
0670   27,3356   02000 0 DP2(-4) 2DEC   1 B-4   1/18
0670   27,3357   00000 1
R0871   RPAD1   2DEC   0373338 B-29   M (-29) =20 909 901.57 FT

0672   REF   5 LAST 536   22,3310   RPAD1   =   RPAD
0673   27,3360   00305 1 R300K   2DEC   6464778 B-29   (-29) M
0673   27,3361   11205 0
0674   27,3362   37777 1 NEARONE 2DEC   .999999999
0674   27,3363   37777 1
0675   REF 31 LAST 1323   26,3331   TFFZEROS EQUALS HI6ZEROS
0676   REF   4 LAST 888   26,3321   TFF1/4   EQUALS HIDP1/4